

SEPTEMBER 1963 35 CENTS

Popular Science

Monthly

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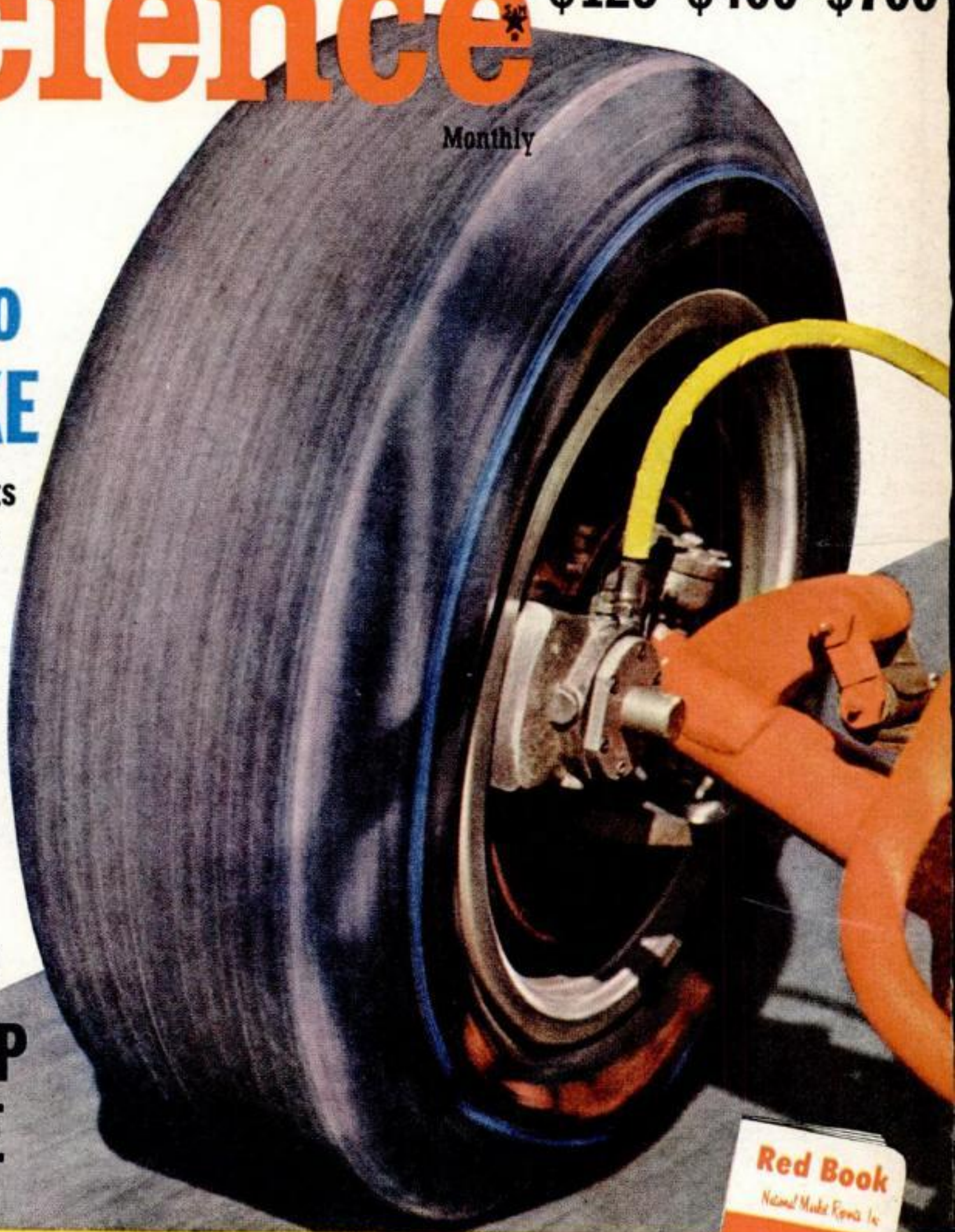
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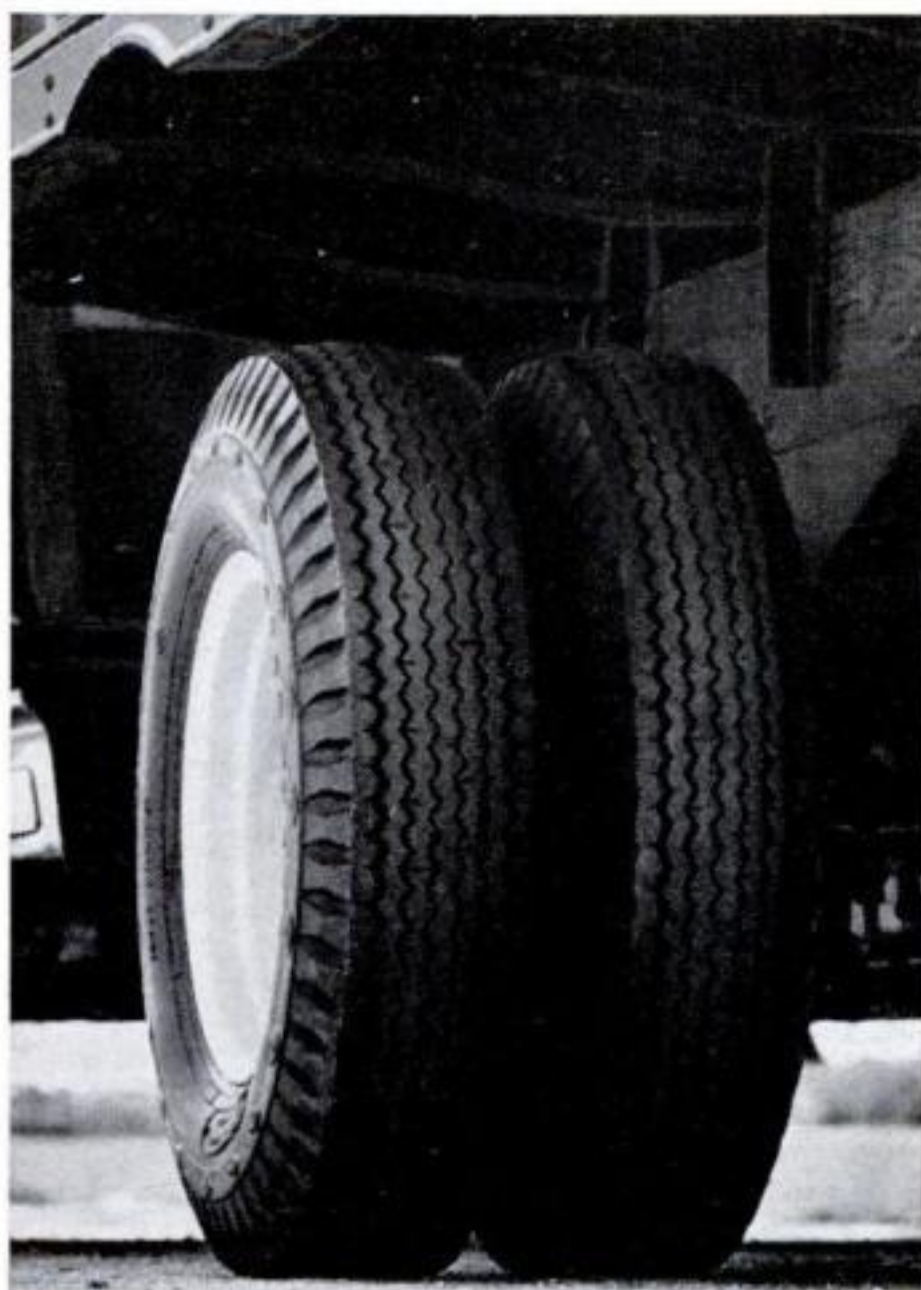


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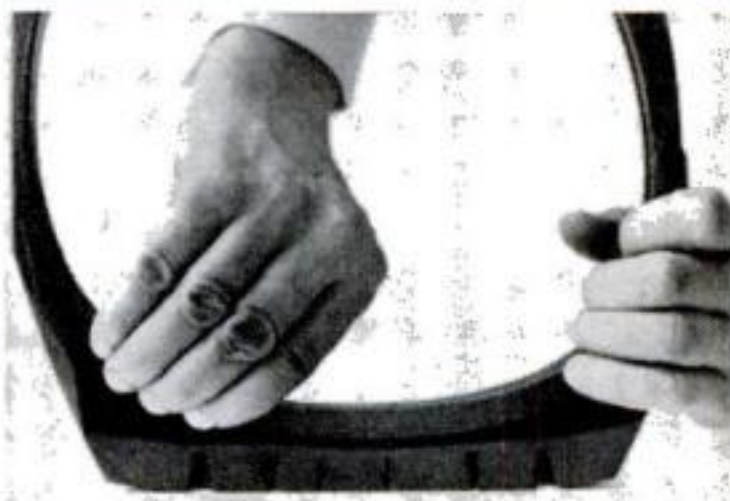
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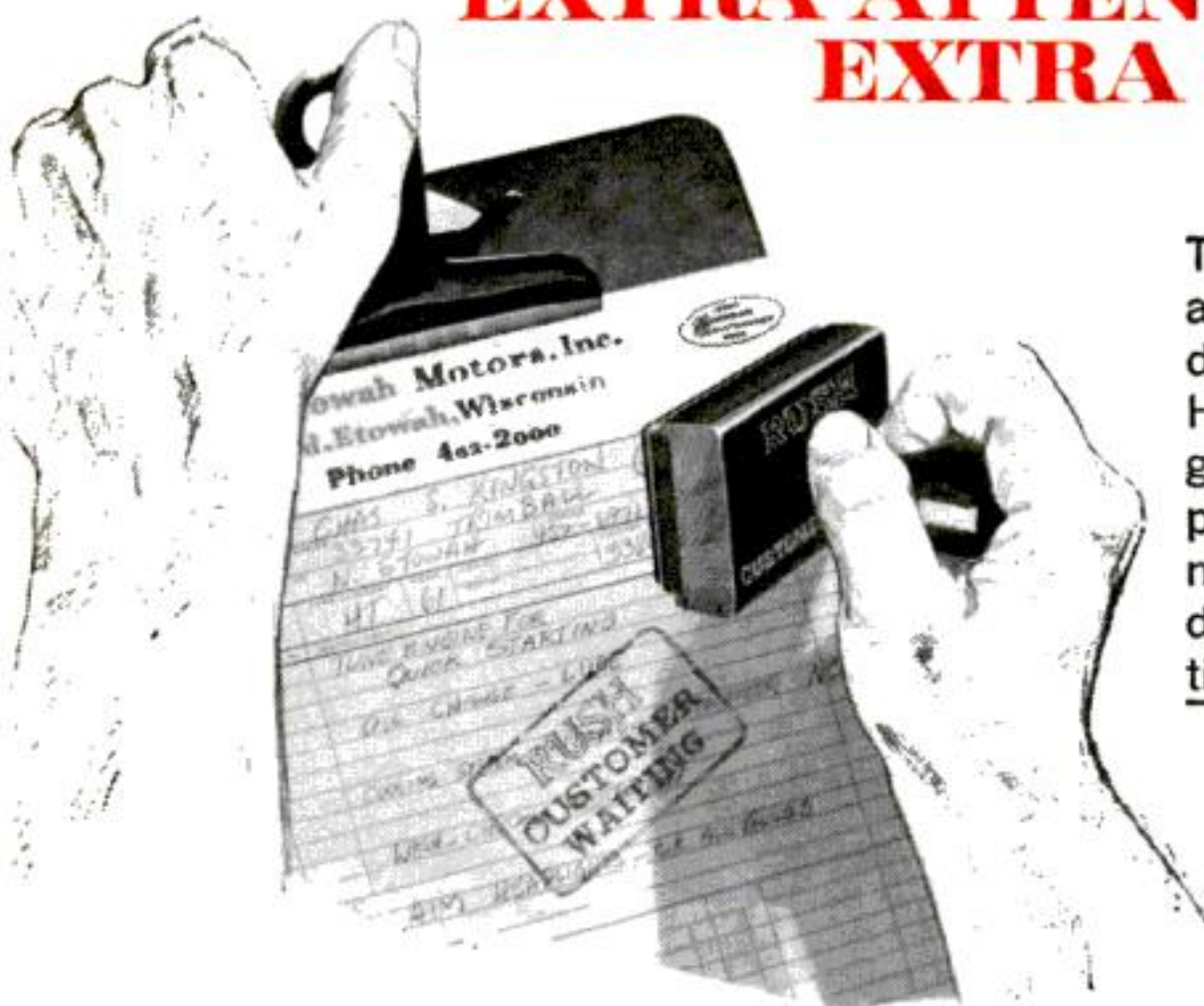
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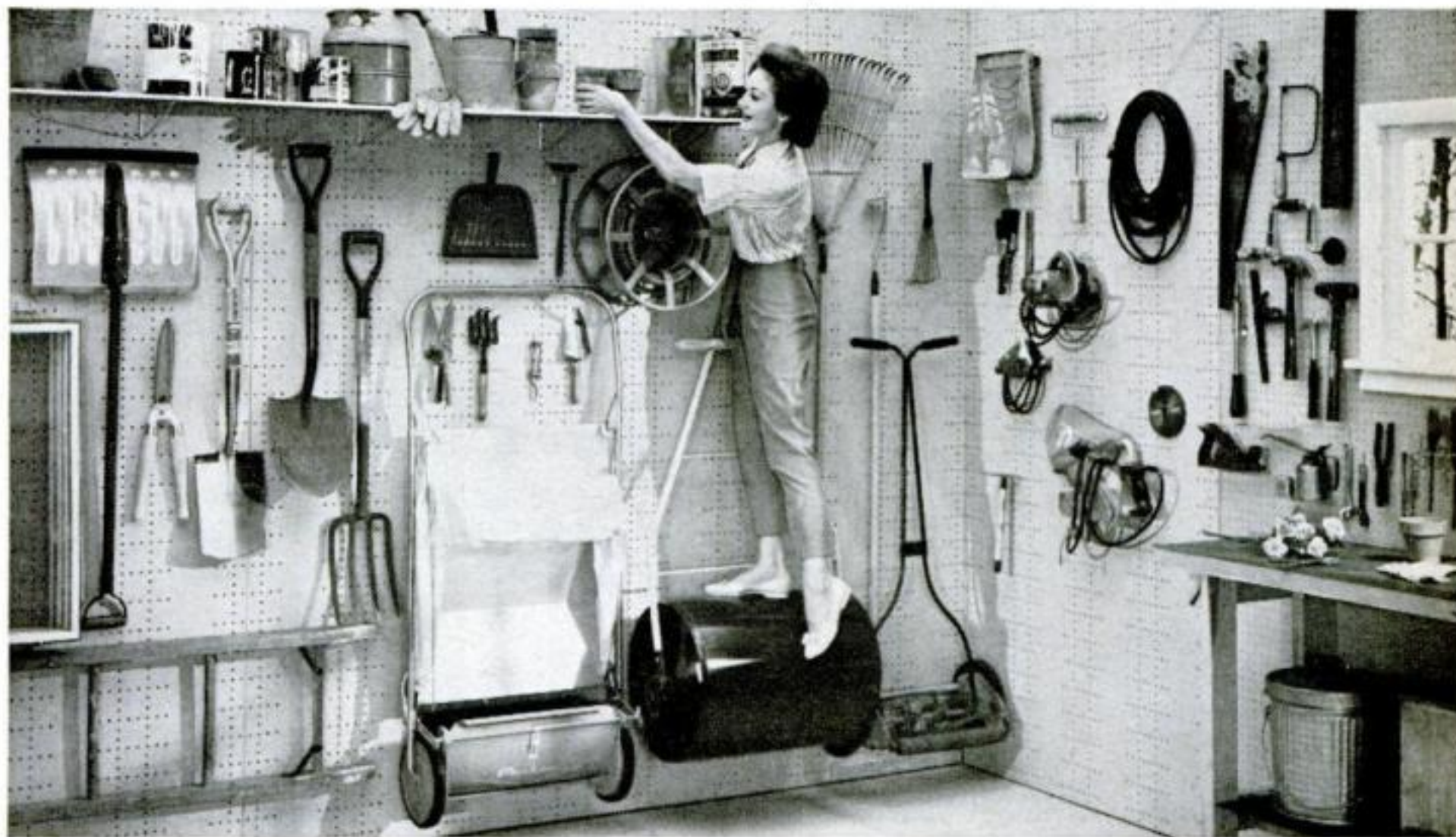


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September 1963



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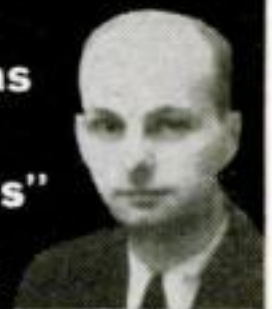
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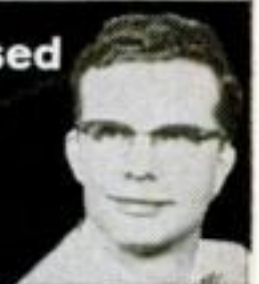
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PS readers talk back

Them Was the Happy Days!

"Any Dope Could Drive a Model T" [July] brought back memories. One thing I remember was winter starting. In cold weather when the grease was stiff, and the old engine could just barely be pulled over with the crank, we'd jack up one rear wheel. This allowed the wheel to turn along with the engine and eased up on the load so you could spin it over faster and it would (usually) "take." Then you had to



jump in and set the hand brake to stop your rear wheel, jump out and let the jack down, jump in again—and away you'd go.

C. E. HOOVER, Ames, Iowa.

... It was a husky man who could start a Ford "on magneto" by spinning the crank. Most of us pulled up on the crank three times, slowly, with the choke ring pulled out, to prime cylinders. Who will ever forget the buzz of the coils, each cylinder a different key; or the slurp of gas as it was sucked into the cylinders? With a quick jerk on the crank, the engine would start and you rushed around the side to pull down the spark lever before the engine died. Then you flipped the switch to the magneto side fast, as every minute of delay meant a drain on the batteries.

In those days we used No. 6 dry cells for starting—four of them making 6 volts. Later the "Hot-Shot" battery came out—a unit of four dry cells in one package. Very convenient.

A rainy night was always troublesome for the Model T; the damp coils would refuse to fire. You had to take them out of their box and put them in a hot oven to dry.

Cold weather also presented problems. If you had no alcohol in the radiator and drained it every night, as many owners did, you'd fill it with hot water in the morning to facilitate starting. If the engine was too stiff to turn over by hand, you could step on the crank. But woe unto the man who had it backfire and slap

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PS readers talk back continued

him on the shin. I had it throw me clear up into the air once.

One ingenious little invention was the priming spark plug, which had a little petcock on the side through which you could squirt ether into the cylinders. It worked, too.

It is difficult for this generation to believe that in those days the speedometer was an extra and its gear had to be attached to the front wheel. Stop lights were extra, too, and so was the rear-view mirror or "cop spotter" as it was called. There was no limit to the extras available. There were lowering blocks, high-speed equipment, California tops, and what not. There were whole catalogues of nothing but Model T accessories and even a magazine devoted entirely to the Model T.

Them were the happy days!

OTTO KLEIN, Morton Grove, Ill.

... We teen-agers were always hard up for tires. By cutting the bead off one old carcass (perhaps with a defect that would have ruined a tube) and prying it like an overshoe over another still intact with the fabric showing, we'd stretch tire life—and our luck, too. At today's speeds, such floppy overshoes would fly off or wrap themselves around the axle. On the Model T they gave us lots of pinchpenny mileage.

HARRY WALTON, White Plains, N.Y.

... A key-of-C tuning fork was a most important piece of equipment for coil and point adjustment and tuneups. To use it, you turned the key to BATT, then turned the crank slowly until one coil started buzzing. Then you rang the fork against the dash and adjusted points until their pitch matched the fork's, then a half turn on the shaft, and repeat on the next coil. Do this properly, and you could get 35 m.p.h. on level roads.

My grandpa used to remove the steering wheel (11/16" crown nut) and put it under his bed, but a friend of mine had a wheel and we rode anyhow.

RICHARD RICHARDSON, Brooklyn, N.Y.

The Stuff of Creation

We would like to correct your figure on the number of elements on display in the Museum of Science and Industry ["He's Got the Whole World In His Hands," June]. We have 84. The only ones we do not have here are technetium, promethium, astatine, and francium.

FREDERICK J. ASHLEY, Museum of Science and Industry, Chicago.

... I also collect elements. I now have 59 and three on order that fall into (in my opinion) the hardest-to-obtain groups: the noble metals (I have only platinum and ruthenium), the

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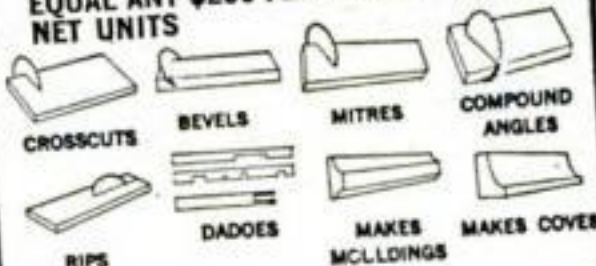
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Better than a screwdriver

and far less costly than having your car laid up for radiator repairs.

Mac's Sealer and Stop Leak stops radiator leaks fast...even high pressure leaks up to 20 lbs. It mixes with any anti-freeze and is served at better service stations everywhere. (Not recommended for people.)

MAC'S SUPER GLOSS CO., INC.
Los Angeles 42, Calif., Cincinnati 26, Ohio

PS readers talk back continued

rare earths, the radioactive metals, and the synthetics like technetium (about \$2,400 an ounce) and astatine (both practically impossible to get) that filled the holes in the periodic chart when they were produced.

If there are other readers interested in this hobby, I can provide small amounts of many of the elements at cost to cover postage and handling. Readers can write me at 4905 Edgemoor Lane, enclosing a stamped envelope.

THOMAS PARKE, Bethesda 14, Md.

The OSS and Sir Lancelot

I find it interesting that some of our so-called "modern" weapons are really not so modern at all ["Deadly Gadgets of the OSS," July]. The four-pronged pieces of steel that were thrown on highways to destroy German tires actually were made and used in medieval times.



Known as "caltrops" then, they were strewn over battlefields to cripple and down the horses of charging knights.

MARSHALL SMITH, Louisville, Ky.

Proof of the Pudding

You say the head gap in the new Revere recorder ["Tape Changer—It's Here at Last," June] is $1\frac{1}{2}$ microns (60 millionths of an inch) while in previous recorders it was from $2\frac{1}{2}$ to 6 microns. You also say that with speeds of 1% i.p.s. it was impossible to achieve frequencies in the area of 10,000 c.p.s. and higher because the head gap gave such large areas of magnetism for each cycle that it wasn't possible to fit enough cycles into such a small space. Thus, the new smaller gap makes it possible to magnetize smaller areas for each cycle and achieve higher response.

This is in direct opposition to the theory of magnetic domains, which states that there is a certain minimal area that can be magnetized in any one direction, in a given material. The size of the magnetic domains in iron (or iron oxide in magnetic tapes) is $1/10,000$ of an inch. No smaller piece of iron can be magnetized in any one direction. Thus $2/10,000$ of an inch are needed for a polarity reversal or cycle. The maximum number of cycles that could be recorded in $1\frac{1}{2}$ " would be then 9,375;

CONTINUED

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Grant Mauk

In the past, many men started businesses of their own—and failed. Some entered businesses that were already on the decline. They were as foredoomed to failure as a buggy-whip salesman. Some had no talent for the businesses they entered. Others had no experience in business management.

Today, all that has been changed by reputable Franchising firms. Our Franchise business is one that has been tried, and tested, and proved by the parent company. It is one that has been shown to have an enormous and a growing market. It is a business that has been brought to a high level of success by many other men. The kinks have been eliminated. The methods and plans that lead to success have been clearly charted. When an ambitious man is given the equipment and training he needs, and follows the plans laid out for him by the parent company, success is the logical result.

There are many kinds of Franchise businesses. Many require investments as high as \$50,000. The profits they pay depend on how well the owner follows instructions.

We have a Franchise business that does not require a large investment. In our business you can get started for a few hundred dollars. We finance the rest of the investment for you and let you pay it in monthly payments so small that the profits on less than one day's service covers your payment. The overall investment is small—yet the potential is \$250 a week net profit. That's for a one man operation. If you have two or three or more men working for you, the potential increases accordingly.

A small dealer just starting and doing his own service should gross \$180 profit from 20 hours service in a week. If he uses 30% for advertising, etc., he nets a clear \$125. If he services 40 hours, net profit is \$250.

With only two men working for him a 35 hour week brings the owner \$420 gross profit. Allowing 20% for advertising, etc., (since he has time to sell) he clears \$336.

What is this business? It's one of the fastest growing businesses in America today. It includes six different services that you perform for the housewife right in her home. No office or shop is needed. No investment in real estate. No problems of finding a good location. In fact, if you have a telephone at home and a car with space in the trunk—you have everything you need except the things we furnish. Your business comes to you on the telephone and in personal calls following up leads generated by National Advertising and by your own local Direct Mail Plan which we furnish. You quote your prices to the housewife, do the job, or have one of your

men do it and collect the money on the spot.

What are these services? The first and most important is the cleaning of carpets, rugs, and upholstered furniture by a revolutionary modern process known as the "Absorption Method." The work is done right in the customer's home. No scrubbing with harsh motor-driven rotary brushes. No soaking with gallons of water. An Aerated Foam loosens the greasy, atmospheric dirt and holds it in suspension until it is removed. A test conducted by an impartial laboratory showed that the new absorption method in the home removed more than twice as much dirt as was removed by the old fashioned machine scrubbing Absorption Method.

Five other services add to your income. With portable power equipment you spray furniture and carpets with a product that retards soiling. You remove stubborn spots like magic. You spray another liquid to make fabrics flame resistant. You mend small damages such as cigarette burns and moth holes, often saving the owner the price of new furnishings. And finally, you deep spray fabrics with a moth killing liquid on which you can give a company guarantee for six full years.

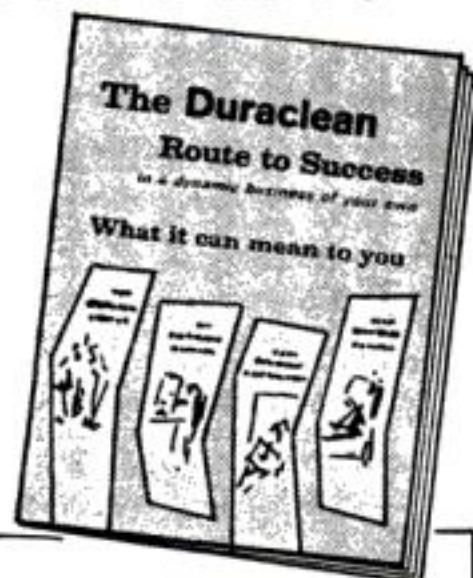
As owner of a business, you have the opportunity to make more money than you could hope to make working for someone else. Also, should you wish to sell, you are building a business with a cash value. When an arm injury made it necessary for Al Svitak to sell after operating his dealership only 17 months, he sold to a prospect supplied by Duraclean at a price 50% above his original investment. G. F. Monroe sold his Texas Dealership after 12 months for ten times his cost. Leo Lubel, after 30 months, sold for \$7,116 over cost. When our Franchise owners want to sell, we help them find buyers.

It's all explained in this free book. Pictures and descriptions show you how the work is done; how to start without giving up your present job; how to build to full time operation through plans worked out for you.

If you are tired of working for others, tired of jumping from one proposition to another; if you have good health, energy, and ambition; if you have a real yearning for independence in a business you own, send for this book. If you have thought that starting your own business would be difficult or expensive, or risky, this book will open your eyes. With our plan it is easier than ever for you to become master of your own destiny in a business you own.

There is no obligation, no charge. No salesmen to high pressure you. Send for this book now. Read it. Then decide if you want to take the next step toward independence.

GRANT MAUK, President; 3-189 Duraclean Building, Deerfield, Illinois



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The Duraclean Franchise is so flexible that it can be fitted to your own ambitions. As a one man business and based on the rates in our National Price Guide you can make a net profit of \$6.00 an hour—\$250 for 40 hours of servicing.

Ward Whitebeck wrote "I have made as much as \$225 in one day." L. Lawson says: "In September, working alone, jobs totaled \$1,475." L. Canaday wrote: "\$1,571 in a single month."

If you wish, you can operate as the head of a multi-crew business with others doing the work.

This increases the profit opportunity as the owner of a business can make as much as \$6.00 an hour gross profit on every hour each employee works. Even after paying him a good hourly wage, the owner can clear \$336 a week for himself with only two men on his staff.

Ed Kramsky wrote, "In my second year I now have two assistants, a nice home, and real security for my family." And, E. Davis reported "Gross income increased \$17,000 this year."

So, no matter at what level you have set your sights, here is a Franchise that is worth careful investigation. Send your name now for the Free Book that tells all angles of the business.

Send name for FREE BOOK

Grant Mauk, President

3-189 Duraclean Building, Deerfield, Illinois

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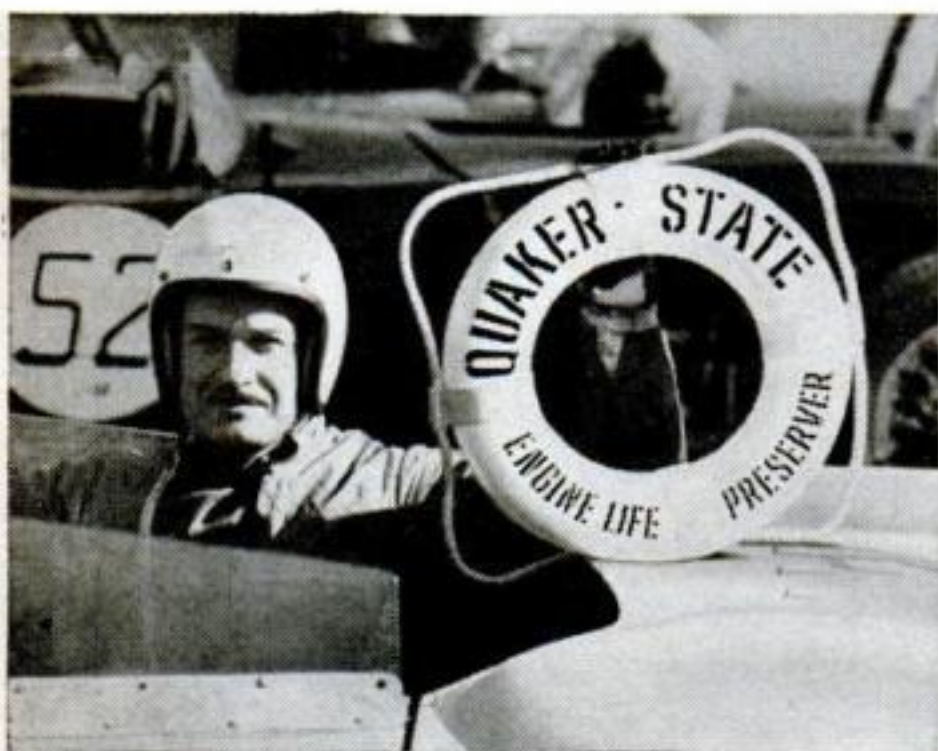
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PS readers talk back *continued*

and the maximum response at $1\frac{1}{2}$ " would be 9,375 c.p.s. The optimum head gap would be one domain in length, or $2\frac{1}{2}$ microns.

By using tape $\frac{5}{32}$ " wide, Dr. Goldmark has done little in miniaturization, and has lost the standardization of parts. His tapes cannot be played on any other machine, and standard tapes cannot be played on his machine. This is a high price to pay for not having to turn over a tape every hour and 20 minutes.

MICHAEL SHANOFF, River Forest, Ill.

Similar "proofs" demonstrated that Dr. Goldmark's Long-Playing Record would never succeed. Now it has completely displaced the old 78s. Overconcern about standardization can be a stumbling block in the way of progress.

Carrier Goes to Bangkok

After reading "Vacationing on Wheels" [May], I thought you might be interested in



the carrier I rigged. We used it to store our pillows, blankets, and cooking utensils on a trip to Bangkok. We also stored two spares—roads in Southern Thailand are nothing but trails.

SAMUEL WAN, Singapore.

Hard Starter Finishes Fine

You published a letter from me [Feb.] on hard-starting a hot engine—my 1962 Dodge Lancer. Thanks to you, the Chrysler Corp. sent representatives to me who not only remedied that problem but have my car in better running shape than when it was new. The solution was the installation of a modification kit No. 85M-1262 to a Holley carburetor.

RAYMOND JAKOBEIN, Stratford, Conn.

New to Britain—Old to France

The small-wheel, large-sprocket bicycle ["Picture News," Apr.] was popular in France 30 years ago. There is one on display here in a bike shop. It is a very practical model for city use because of easy storage and compactness for packing in a car.

FERDINAND BRIGHAM, Cambridge, Mass.



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Dr. Wernher von Braun Answers the Question:



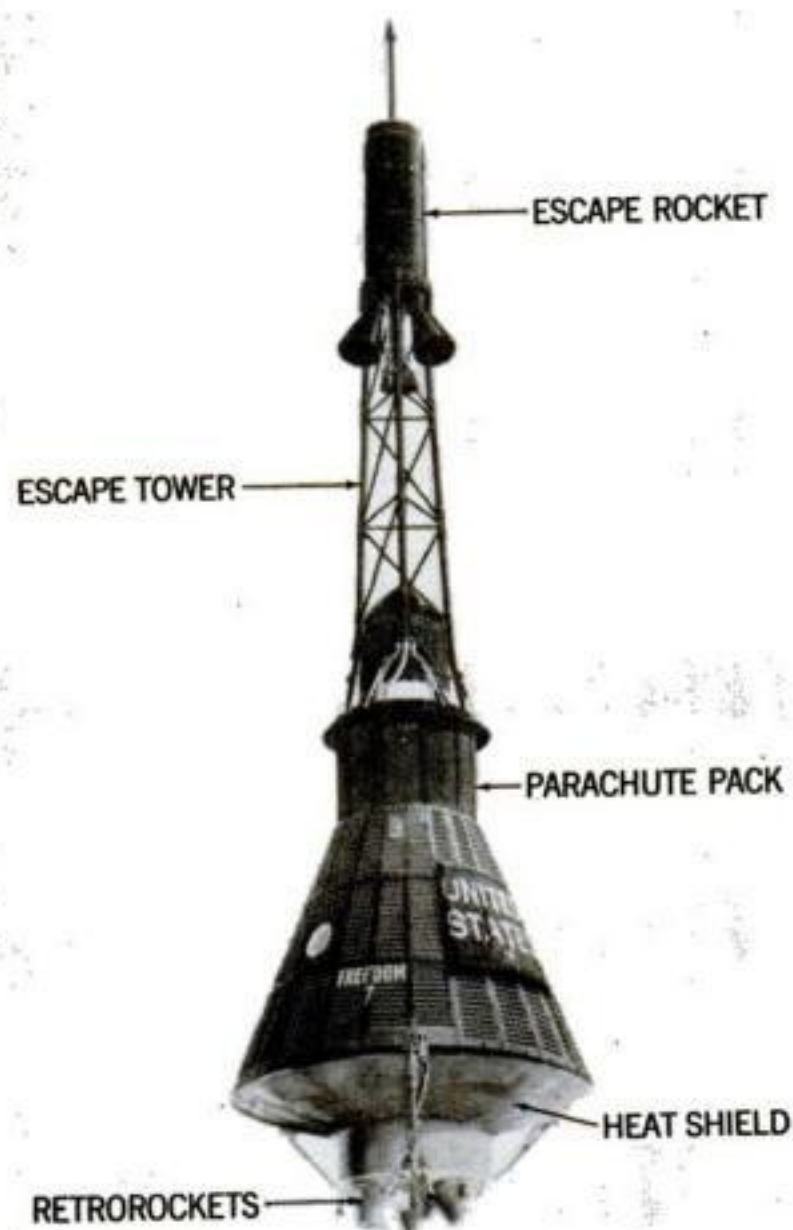
Dr. von Braun, right, briefs astronaut John H. Glenn Jr., first American to go into orbit.

Can an astronaut in trouble bail out?

That depends on the situation. Obviously an astronaut, once he has been injected into an orbit around the earth, cannot simply abandon a stricken spacecraft and live. Equipped with nothing but his space suit and a reaction pistol, he cannot "retro" himself out of the orbit and hope to survive a blazing re-entry into the atmosphere, without the protection of capsule and heat shield.

On the other hand, a bail-out during the first 30 or 40 seconds of his booster rocket's ascent would subject an astronaut to no more severe an aerodynamic shock than in parachute ejection from a fast aircraft.

Because of the wide spectrum of flight conditions encountered during a typical orbital mission, the designers of the Mercury capsule, our first manned spacecraft, decided to adhere to the ground rule that the astronaut shall stay with the ship, come what may. Instead of providing emergency means for the astronaut to eject himself into what might be a marginal or deadly environment, they furnished all conceivable safety features to bring the capsule itself to



Mercury capsule provided astronaut with these means to bail out or end orbiting prematurely.

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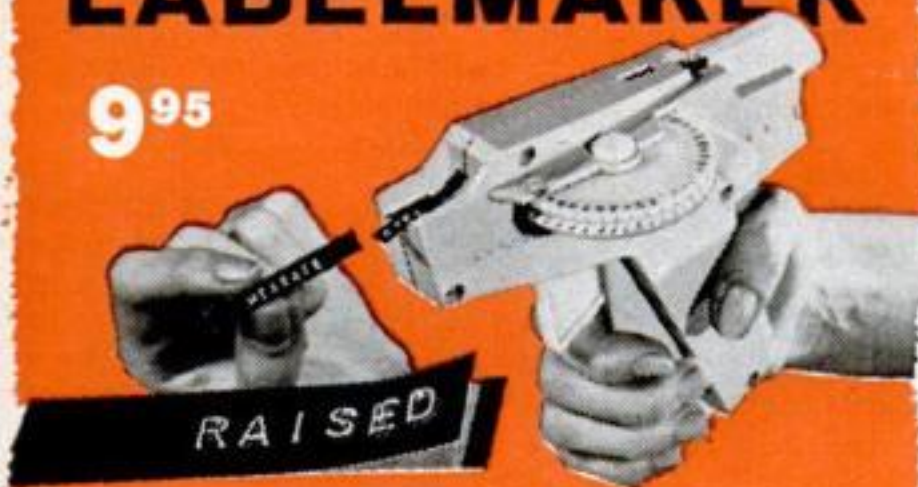
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Dr. Wernher von Braun continued

earth intact, with the astronaut safe inside.

Q *What is the emergency procedure during the launch phase?*

A In case of a sudden emergency during the boosted ascent into orbit, the main requirement for safe capsule recovery is a suitable mechanism for rapid separation of the capsule from the boost rocket.

In Project Mercury this mechanism consisted of a Launch Escape Tower extending forward from the top of the capsule, with a powerful short-burning solid-fuel escape rocket in its tip. Upon activation by the astronaut, the escape rocket would be fired while a set of explosive bolts would sever the capsule from the aborting Atlas rocket. Simultaneously the Atlas engines would be shut down—and the escape rocket would hurl the spacecraft and its occupant away from the booster with a brutal 20-G blast. The main purpose of this escape rocket was to put a safe distance, as quickly as possible, between the spacecraft and the stricken booster—which, like a jet plane hit by enemy fire, conceivably might explode at any moment. In case a dangerous fire developed while the Atlas rocket was still sitting on its launch pad, the Mercury escape rocket was powerful enough to carry the capsule to a safe altitude for deployment of the capsule parachute.

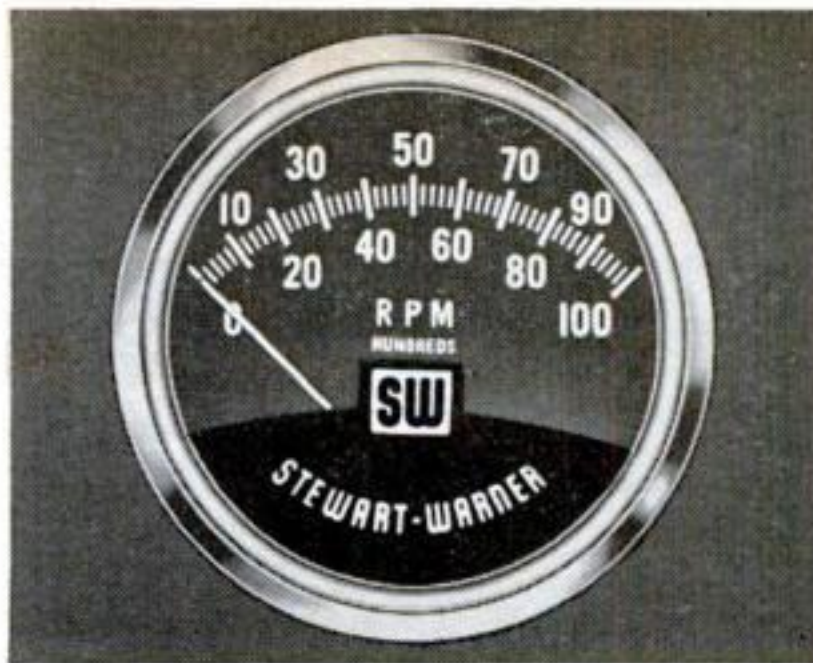
Q *What can an astronaut do if trouble strikes later?*

A About 2½ minutes after lift-off, with the two Atlas *booster* engines already dropped off and the flight continuing under *sustainer* engine power, the Launch Escape Tower is jettisoned. By now, the Mercury-Atlas combination has risen above the sensible or perceptible atmosphere, and a failure in the complex Atlas control system would no longer lead to structural breakup and resulting explosion. Aerodynamic forces during an emergency separation have likewise become negligible.

As a result, separation can now be effected simply by shutting off the Atlas sustainer engine—and gently pushing the capsule away from the Atlas with the help

CONTINUED

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Dr. Wernher von Braun continued



Escape rocket for coming three-man Apollo moon capsule, upside-down on test stand, gets flaming trial. Many times size of Mercury version, it has four flaring nozzles instead of three.

of a set of rather weak "posigrade" rockets. Since the spacecraft has not yet attained orbital speed, it will soon drop back into the denser layers of the atmosphere. The astronaut must therefore turn his capsule around so that its blunt heat shield will be facing the onrushing air. This places him in a safe condition for re-entry.

About five minutes after lift-off, if no emergency has developed during the ascent phase, the Atlas-Mercury system goes into orbit. Immediately the capsule is separated from its booster and turned around. This, again, puts it in a safe re-entry position.

But while re-entry into the atmosphere is the automatic consequence of shutting off Atlas power in an emergency at *suborbital* speed, return into the atmosphere from *orbital* flight always requires a separate retro-fire maneuver to reduce the initial orbital speed. The rocket power for this maneuver is provided by the so-called retro-pack strapped to the heat shield of the Mercury capsule—the same retro-pack that normally ends an orbital flight.

Thus, emergency descent from an orbit is simply a premature termination of the original flight plan. ■ ■

.....
Dr. von Braun will consider answering questions from readers of POPULAR SCIENCE in the magazine, but he cannot undertake to answer each one by mail. Letters to him should be addressed in care of POPULAR SCIENCE, 355 Lexington Ave., New York 17, N.Y.

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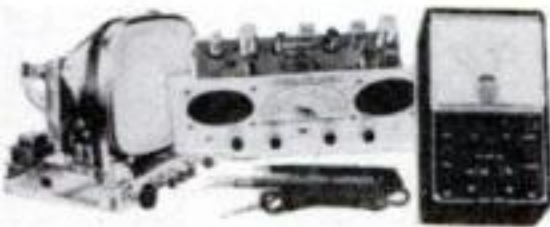


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PHYSIOLOGY

The girl who's all eyes

Can you see with your fingertips? A Russian girl named Rosa Kuleshova can, and many other people may share the talent, according to Soviet sources. Rosa can also see with her toes and the tip of her tongue—but not very well.

Communication with the Soviet Union being what it is, we don't know how Rosa, of Nizhny Tagil in the Ural Mountains, discovered she could read large type and distinguish colors by touching things. She's now in Moscow being tested at the Institute of Problems of Transmission of Information and the Institute of Biophysics of the Academy of Sciences.

Surface roughness and temperature play no part in Rosa's ability to recognize patterns and colors. She correctly read test patterns projected on a screen of uniform roughness through a filter that removed infrared from the light, but she couldn't read a pattern projected with infrared light alone. By using variously spaced dot patterns, investigators determined that she has about 10 light receptors per square millimeter in her fingertips. The color sensitivity of her fingers seems to be about the same as that of the eye—they even see a

More than two million Russians are expected to travel on hydrofoil vessels this year—50 percent more than in '62. Hydrofoils are skimming the Volga, Ob, Dnieper, Irtysh, and Amur rivers.

blue "ghost" after they have "stared" at a bright red source. With practice, she was able to detect light with her tongue and toes (right foot only).

Meanwhile, back in Nizhny Tagil, the local school authorities decided to see if they could find other people with the same ability. Out of 50 blindfolded art students,

one in six could differentiate between light and dark by touch, and could learn to recognize some colors.

MEDICINE

Sleeping while weightless

Like astronauts and porpoises, *you* can enjoy the benefits of weightlessness, according to Clark T. Cameron, inventor of a sleep bath called the Aquarest. Floating unsinkably in a 10-percent solution of sea salt, you relax so perfectly that three or four hours of immersion is equivalent to a full night's rest on a bed, he says.



The 92-inch fiberglass tank is more than just an oversize bathtub: Hidden in its side is a circulating pump that squirts in the solution through five jets on each side, massaging the sleeper. The bath is maintained at body temperature.

There's no danger of turning over, Cameron claims, because flotation reduces "the pressure stimuli which cause you to turn over for relief in your normal sleeping environment." People with "body asymmetry," however, "may develop a slight list to port or starboard." The jets tend to counteract this effect, but Cameron also suggests using a small weight for ballast.

The watery bed is endorsed by a scientific advisory board consisting of a number of hospital officials and Margaret Mead, the anthropologist.

PSYCHOLOGY

The meaning of death

Should a doctor tell a patient that he is dying? This question is explored with new insight by Dr. C. Knight Aldrich of Chi-

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Science newsfront continued

cago in a paper called "The Dying Patient's Grief," published in the AMA Journal.

"Advocates of telling," he says, "often recommend *not* telling patients whose personalities are too 'weak' to tolerate the news. . . . However, my experience . . . suggests that it is particularly difficult for the strong, well-integrated personality to accept with equanimity the idea of his own death."

The key to the paradox, he says, lies in the nature of grief, "the emotional experience of survivors at the loss of a friend or relative. It is a reaction to separation, and may [also] occur in anticipation of death."

"The patient experiences a similar reaction of grief if he permits himself or is encouraged to anticipate his own death. . . . The more personality resources a person has, the more friends he has and the closer are his relationships with them; the more friends and close relationships, the more grief; and . . . the more grief, the more suffering."

This helps "to explain the . . . greater acceptance of death often seen as death approaches. As the illness continues . . . the significance of other individuals to the patient is gradually reduced and the extent of the anticipated loss is reduced . . ."

How can the doctor best help his dying patient? Dr. Aldrich suggests the patient be allowed to make his own choice whether or not to face death. "Suppose the surgeon says to him, 'Mr. X, as I know you anticipated, we found a cancer. We did our best to remove all of it, but in situations of this type we can never be absolutely sure. Although we are optimistic . . . I suspect that you had better arrange things so you will be carrying somewhat less responsibility.'"

"An approach of this type makes denial possible for the patient who needs to deny, and at the same time paves the way for acceptance if he is prepared to accept. The patient who needs to deny . . . can put his affairs in order . . . as he would before going into military combat."

OCEANOGRAPHY

The sunken horde

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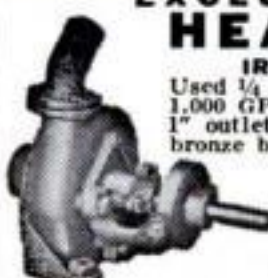
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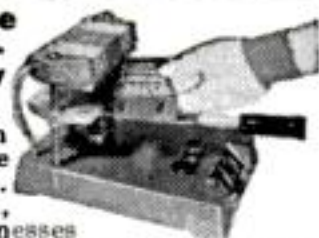
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Science newsfront continued

space division of North American Aviation. Their estimate is based on sources such as Lloyd's of London, which recorded an average annual loss of 398 ships since 1902, and an old French shipping directory, which showed losses of more than 3,000 ships per year up to the mid-19th century.

Using a conservative average of 500 sinkings per year for 2,000 years, Rechnitzer and Terry arrived at one million, a density of about one ship per 14 square miles. They think the true figure may be as high as a ship per square mile.

SPACE

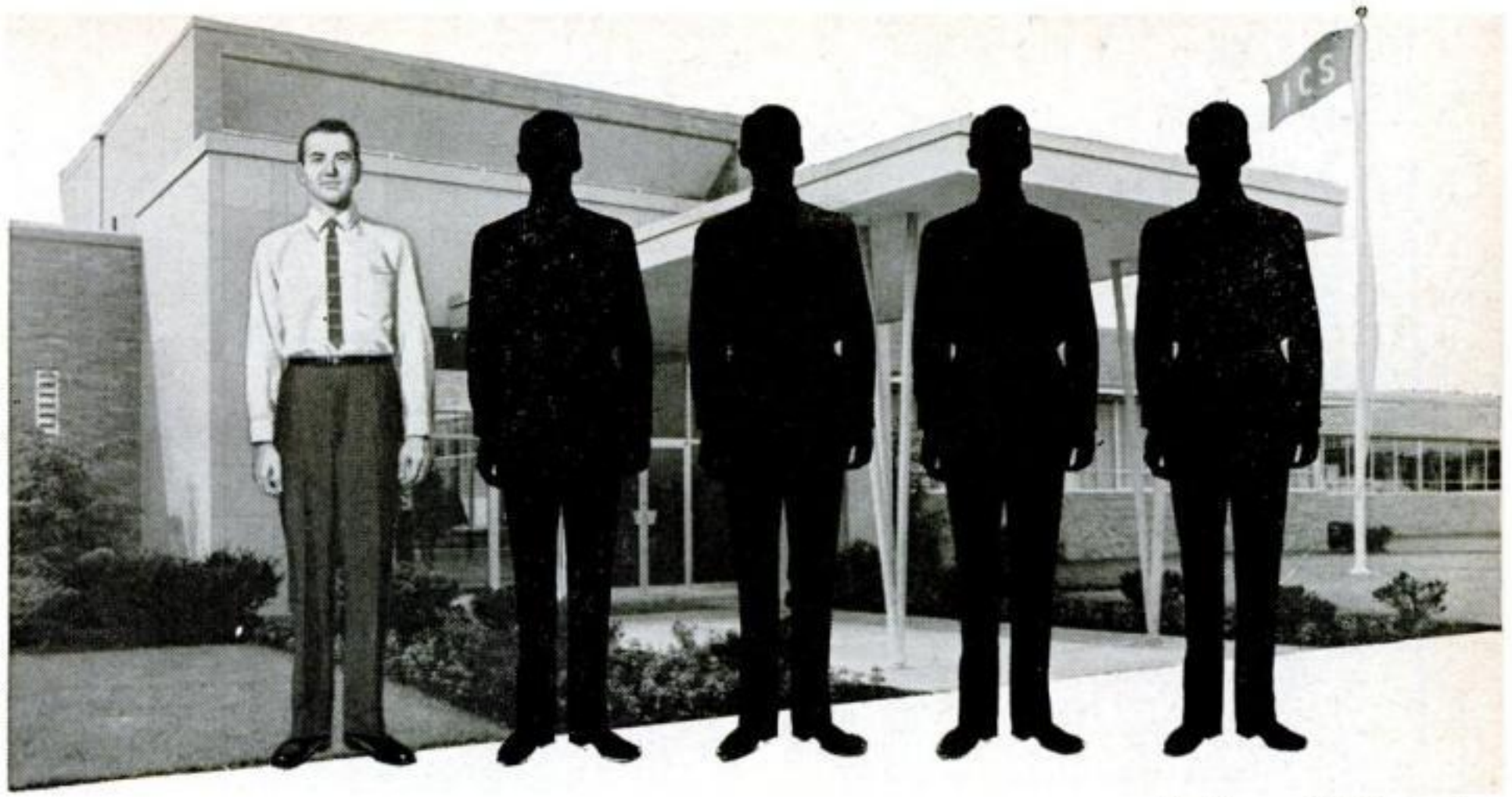
The big motor goes off

As the moon slid across the edge of the sun last July 20, I watched a white-hot flame spurt more than 200 feet above the grassy hills of Coyote, Calif., south of San Francisco. United Technology Center, a division of United Aircraft, was test-firing the biggest solid-fuel rocket motor ever built, a 250-ton, 75-foot brute.

To set it off, a small rocket motor inside the big one sprayed flames that filled the hollow "core" of the giant motor—which was built of five segments, like a stack of doughnuts. Each of these was a steel-jacketed cylinder of propellant, ten feet in diameter with a four-foot hole in the middle. From a nozzle atop the stack a cone of flame shot into the sky. For 112 seconds a sound like continuous thunder rolled over the site. A cloud of yellowish-white smoke rose some 3,000 feet into the air. Heat waves and chunks of flaming propellant started grass fires on the surrounding hillsides.

It was the first test-firing of the motor designed for the Titan III, the Air Force launch vehicle that will lift the Dyna-Soar manned space glider into orbit, perhaps in 1965. Two such motors, each producing over a million pounds of thrust, will serve as a dual first stage, strapped to the sides of a modified Titan II missile.

Although the motor test-fired was about the size of the Atlas booster that sent Gordon Cooper into orbit, it produced 2½ times as much thrust. UTC had twice test-fired single segments of the solid-fuel stack, but this was their first multiple-segment test-firing. Now they know it works. ■ ■



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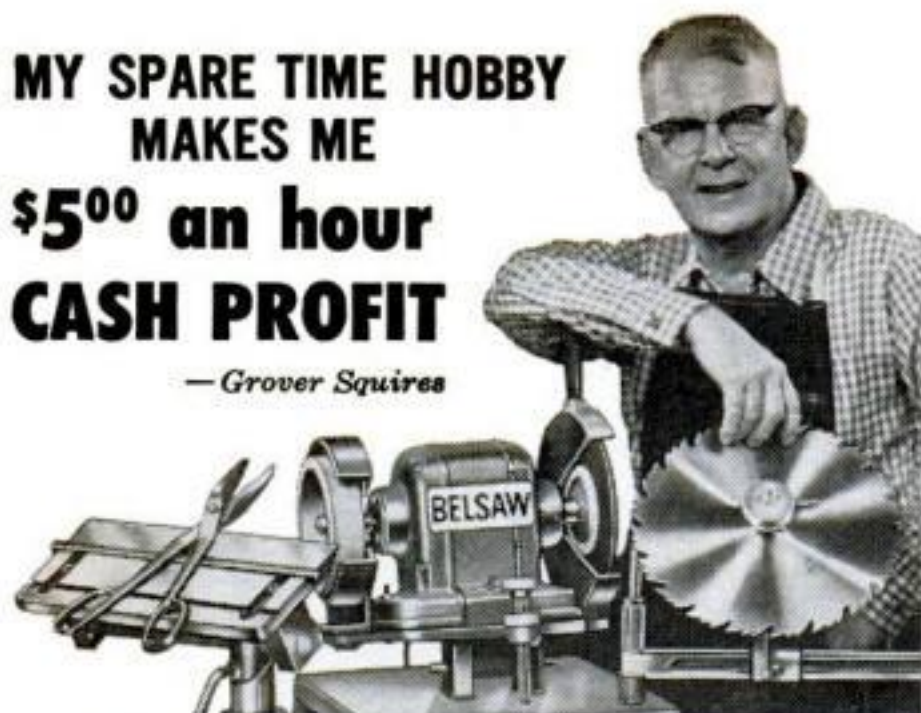
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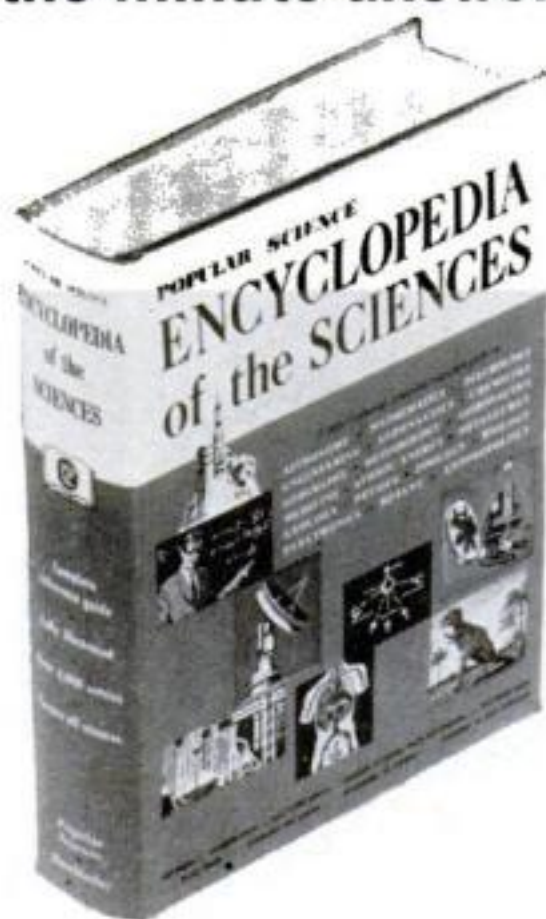
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FROM aardvark* to Zworykin**, the *Popular Science Encyclopedia of the Sciences* cuts a neat path through a labyrinth of over 4,000 terms drawn from all branches of science. Leafing at random, I found definitions of "mistral," "hyperesthesia," and "DNA"; explanations of relativity, the Second Law of Thermodynamics, and rocket engines. Names are there, too. I was pleased to discover, besides obvious entries like Einstein or Freud, scores of contemporary scientists in the news today, such as Glenn Seaborg and Harold Urey.

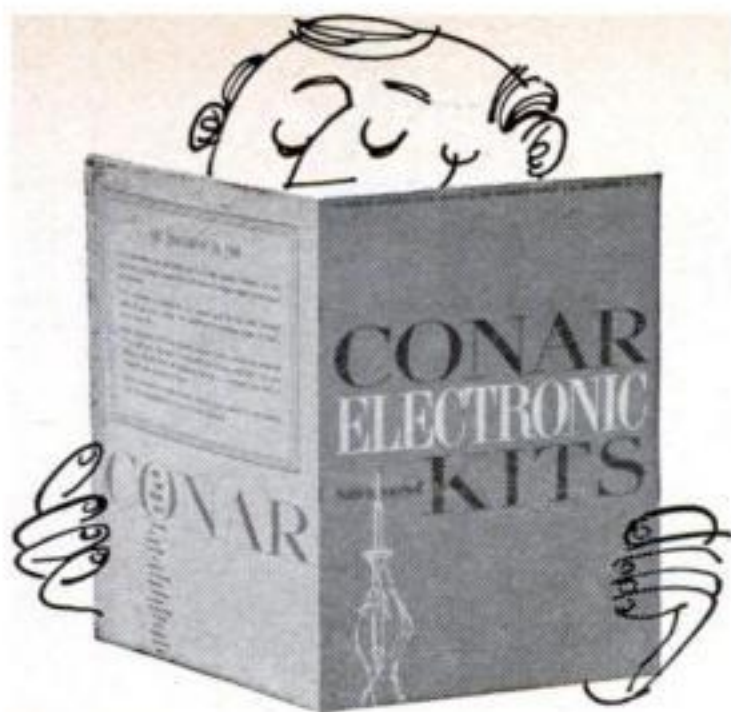
The one-volume 762-page book is not aimed at satisfying the specialist, but to serve as an adult general-science reference work. It wastes no words: Its style is terse, its cross-reference logical throughout the volume.

In addition to a general index, there is a study guide which outlines the main categories of science, and a chronology of the major events in the history of science. Pictures and diagrammatic illustrations are abundant.

The regular edition sells in bookstores for \$9.95; with a thumb index it's \$10.95. Both are available to **POPULAR SCIENCE** readers through Popular Science Books, 355 Lexington Ave., NYC 10017.—Joan Steen.

*that African mammal

**Russian-born physicist who developed kinescopes and iconoscopes



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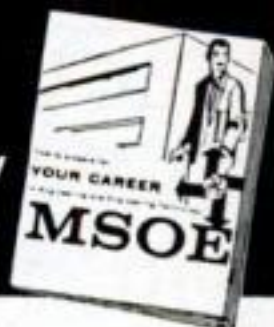
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Aviation acclaim for a PS editor



LAST May, the Aviation/Space Writers Association held its 25th annual meeting in Dallas. The hero of "honors night" was Devon Francis, now Automobile Editor of POPULAR SCIENCE, who in 1938 founded and became first president of AWA.

Devon Francis today writes perhaps the most informed, inside-story automobile magazine articles in the country. But as a pilot and winner of many top aviation-writing awards, his heart still belongs to his first love—flight—born in a JN-4 (Jenny) biplane in which he first flew in 1920.

On that Silver Anniversary AWA Night at Dallas, his tongue was triggered by nostalgic memories and aviation accomplishments he has seen pass from dreams into reality. In conclusion, he offered a poem he had written for the occasion:

*What is man's goal? To grub, to fight
Until the blackness of a night
That we call death enfolds his sleep,
Commits him to a timeless deep?*

Say not!

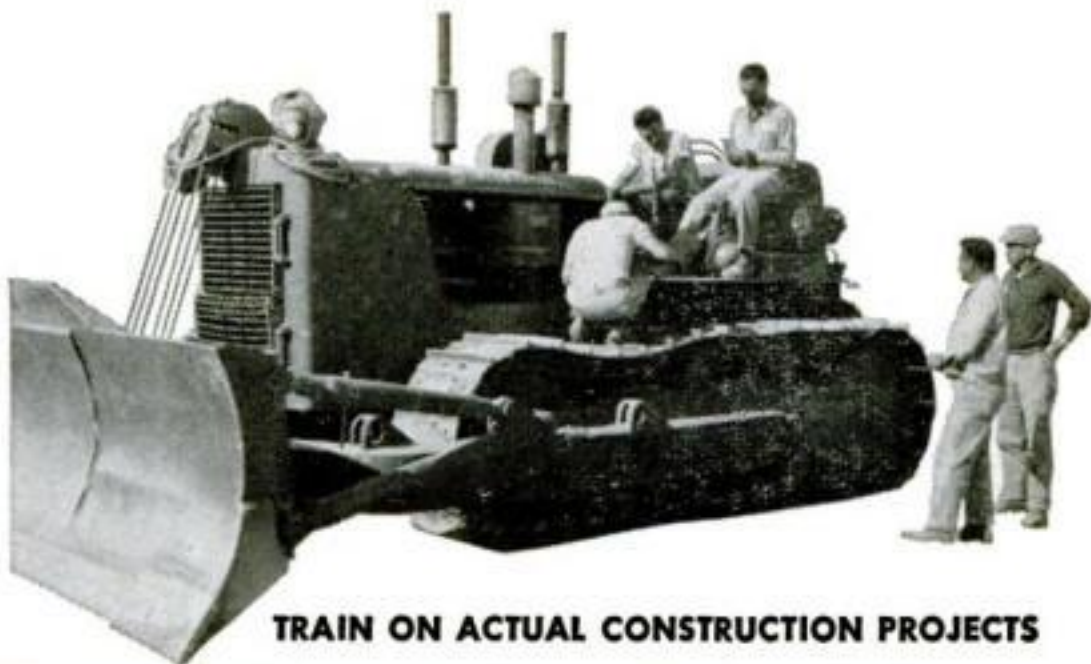
*In this swift pass from womb to grave
Man's sacred mission is to pave
The way for generations yet to be;*

*To search the stars for all to see
The inner glow of soul and heart
That tend to make us all a part
Of universal destiny.*

*On fiery pedestal we stand
To arc the sky, to probe a strand
Of Mars; break the shackles of our
Earth,
Redeem the promise of man's birth,
And shooting onward, earthly clod,
To touch a fingertip with God.*

As he finished speaking, there was a silence, then an ovation.

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Getting Ahead

By Dr. Lewis R. Fibel

A monthly column to help you prepare yourself for a better job

Better engineers: A new, more sophisticated breed of engineer is being trained at Purdue University and other engineering centers. Traditional practices are being left behind in order to train students to solve problems no one has solved before. The systems these engineers will design may be so costly that they must be right the first time; they can't afford to try again.

In Purdue's School of Mechanical Engineering, for example, third-year students have already absorbed heavy doses of math and physical sciences, as

well as advanced concepts of electrical and mechanical engineering. They start tackling problems like designing a switching-control system to operate an industrial plant.

By the senior year they are working on fuel cells, electromechanical converters, and power plants for space flights.

Purdue has found students well able to meet the challenge; in fact, the number of students at the School of Mechanical Engineering has risen from 590 in 1960 to 767 in 1962.

Exam psychology: If you want to do well on tests you should try to hit a happy medium between relaxation and anxiety, according to Dr. James H. Straughan, assistant professor of psy-

chology at the University of Oregon.

Results of Dr. Straughan's study suggest that there is an optimal tension level for memory and recall. High anxiety is not much help—any time.

"I am a college freshman majoring in mathematics. What are the possibilities in this field besides teaching?"—S.F., Manhattan, Kan.

There are 30,000 mathematicians in the country who are *not* elementary or high-school math teachers. More than 40 percent work in private industry; a little under 40 percent are college and university teachers; the rest work for government or other non-profit agencies. Applied mathematicians—statisticians and actuaries—are not included in the totals.

Mathematical work falls roughly into two classes: theoretical and applied. Theoreticians are concerned with the logical structure of mathematical systems and explore the relations among mathematical forms. Applied mathematicians develop techniques and approaches to solve problems in other fields—physics, biology, and the social sciences, for example. A growing number of mathematicians are concerned with the theoretical problems involved in program-

ing high-speed computers to give numerical solutions to complex problems. Major industrial employers of mathematicians are the electrical-equipment, aircraft, and missile industries.

For more information you might read these pamphlets:

Careers for the Mathematician, \$1, Career Publications, Inc., 14 W. 45 St., NYC 36.

Careers in Mathematics, 25c, Science Research Associates, 57 W. Grand Ave., Chicago 10.

"How can a person living on the West Coast of Africa take a correspondence course in photography?"—R.W.R., Brooklyn, N.Y.

Most correspondence schools are international and would send courses to Africa. Schools offering photography include:

American School of Photography, 835 Diversey Parkway, Chicago 14.

New York Institute of Photography, 10 W. 33 St., NYC 1.

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Testing electric lines and outlets. The Model 163 will measure the voltage of any electrical line, outlet or socket. Most lines vary between 110 volts and 125 volts depending upon power line load. Some lines are 220 volts (actually vary between, 208 volts and 240 volts). Model 163 will accurately measure all such lines whether A.C. or D.C.

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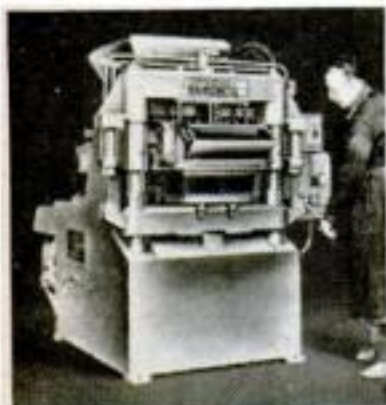
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Getting Ahead ^{continued}

School of Modern Photography, 721 Broadway, NYC 3.

"Where in Ohio can I study aircraft maintenance?"—C.L.O., West Milton.

Here are three schools:

Modern Aircraft Welding School, 666 Olentangy Rd., Columbus.

Hower Vocational High School, 110 W. Exchange St., Akron.

Central High School, 3520 Central Parkway, Cincinnati.

"Is it possible for an adult who has the required credits but who has been out of high school for a long time to get into college without taking refresher courses or an entrance exam?"—P.A., Irvington, N.J.

Many colleges offer noncredit courses for adults which are generally open to all who may benefit from them.

However, your question sounds as if you were interested in getting a degree. I think you will find that most colleges welcome a mature student. High-school graduation or a high-school equivalency diploma would be a prerequisite, and you would be required to take entrance examinations if this is a part of the regular admission procedure. However, consideration is usually given to the time that has lapsed since an applicant was in high school. Many colleges also give placement tests to help the student and his advisor select appropriate courses. These might also indicate the need of refresher courses or not. I would strongly recommend that you follow the advice of the faculty.

There are a large number of local schools you might apply to. You might check Abraham H. Lass's *How to Prepare for College* (95c, Pocket Books) for listings, as well as for general information. The School of General Studies of Columbia University, in your area, is exclusively geared toward adult students.

"Are there any companies that will give me a job so that I can support my family, and also send me to a college so that I can earn an engineering degree?"—P.M., Oahu, Hawaii.

Many firms assist in education to some degree. Frequently this consists of adjusting

Getting Ahead continued

work schedules so that employees can attend school.

Less often, companies have a "tuition rebate" plan whereby they reimburse employees for some educational expenses. But basically, the responsibility and initiative must be yours.

"I am over 30 and forced to acquire another trade. I have had some experience in auto mechanics, but would like to specialize. Can you suggest some local schools?"—C.H., Kansas City, Mo.

These five might be of some value. Most offer specialized courses in addition to a broad curriculum:

Central Technical Institute, 1644 Wyandotte St., Kansas City.

Finlay Engineering College, 10th at Indiana, Kansas City.

Stevenson Auto & Electrical School, 2002 Main St., Kansas City.

U.S. Trade Schools, 500 E. 11th St., Kansas City.

David Ranken, Jr., School of Mechanical Trades, 4431 Finney Ave., St. Louis.

"Would you recommend an accredited correspondence course in commercial art?"—C.A.W., Wheaton, Ill.

The following schools are all accredited by the National Home Study Council, and offer art courses for either vocational or avocational purposes:

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Famous Artists Schools, Westport, Conn.

International Correspondence Schools, Scranton 15, Pa.

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The Case Against Bucket Seats



DETROIT'S decision to put the country in bucket seats comes as one more saddening reminder of American technology's genius for getting in people's way.

The bucket seat, as the more affluent car owner knows, is an automobile armchair without legs or armrests. Being large enough to accommodate only one person, it is a thing of loneliness in an automobile, and a thing that breeds loneliness.

The girl in a bucket seat on a moonlit summer night is not likely to slide closer to the boy in the bucket seat behind the wheel and rest her hand on the back of his neck, no matter how sweet the scent of honeysuckle in the air. The bucket seat frowns on that sort of impulse. Its function is to keep people isolated in upholstered comfort so they can savor the full smoothness of the miracle-suspension ride without emotional distraction.

Pity the girl in the bucket seat who wants to break out of isolation. Her escape is blocked by an imposing obstacle called the "console," a low barrier dangerously studded with upright levers, metal boxes with sharp cutting edges, and gimcracks that set lights flashing.

Apartness through progress. Reports from Detroit are that the automobile makers believe we are ready to buy bucket seats in mass quantity and that they will furnish them on new car models accordingly. It is pointless to appeal to Detroit's sense of romance. Detroit is convinced that the American is really in love with his car, not his girl, and will produce several motivational-research studies to prove it.

But abusing the automobile makers is

CONTINUED

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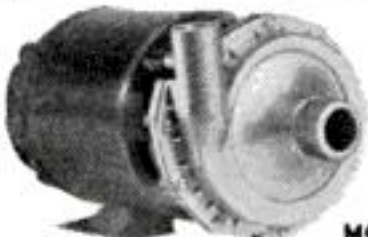
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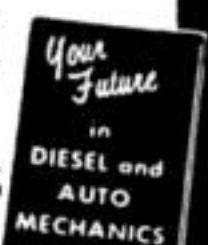


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unfair. Car makers are merely the brokers of a new age in which miracles of technology are performed to keep people apart by bringing them closer.

To illustrate, a Washington man reports that he noticed a car the other day with old-fashioned, all-purpose seats waiting at a red light. The girl passenger had both arms around the driver and was bussing him warmly about the whiskers. The car radio was broadcasting the news. The man driving was offering his cheek to the girl, talking on the car telephone, racing his engine, and watching the traffic light.

This was a poignant vignette of the contemporary American trying to steal a moment with his girl while his car, his telephone, his radio, and his radar-controlled traffic-signal system scream, ring bells, howl, and flash lights at him to break it up.

The chariots of love. The evil of the bucket seat is that it makes the stolen moment just a little more difficult. It also carries us another step away from the age when the American boy who found the parlor and the front-porch swing too public for romantic purpose could call with the buggy. In those days it was respectable for a man to like his horse, but he would have punched the nose of anyone who accused him of loving his buggy.

The buggy yielded to the Ford, which increased the territorial radius over which boy and girl could behave foolishly. The car's functions were to get you out of the constricting atmosphere of the parlor and to provide a settee-like seat on which the growth of a human relationship could be measured inversely by the distance between driver and passenger.

Internal-combustion parlor. The bucket seat threatens to end this long American tradition. It is just an armchair without legs, and armchairs are furniture for parlors, and parlors are poisonous with the constricting atmosphere that drove boy and girl to the buggy to commune.

What Detroit proposes, in effect, is to turn the American car into a parlor on wheels. This could be the most ill-fated project to come out of Michigan since the Edsel. The indicated course of action is clear: The Government, which has a big stake in the auto industry's continuing good health, should undertake an immediate study of its own to determine whether the American really does love his car instead of his girl.—Russell Baker.

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Detroit report

By Devon Francis

A Chrysler car for Indy?

With Ford successfully exploiting the excellent showing of the Lotus-Fords at the Indianapolis 500, Chrysler Corp. also is considering participation next year.

Meyer-Drake, builders of the Offenhauser engine, which has dominated Indy for the past 30 years, reportedly tried to make a deal with Chrysler: to develop cooperatively, a new eight-cylinder Offy engine. It was to be suitable for racing and, in milder tune, for the consumer market. But Chrysler doesn't seem too interested, especially since several new engines are threatening the Offy's superiority. Meyer-Drake reportedly made a similar offer to Ford several years ago, but was turned down.

In the next few months Ford will produce larger and smaller versions of the engine used in the Lotus-Ford for sale to the general public and stock-car and drag-strip drivers.

The Lotus and Ford people already are planning improvements for next year. Cars and tires will be faster, they say. Overtures have been made to several top drivers, including, it's reported, Parnelli Jones, winner of this year's race in a Meyer-Drake. Now PS hears that the famous Holman-Moody shop in Charlotte, whose 427-inch Fords have dominated major stock-car races this year, is building two new lightweight cars to compete at Indianapolis. Like the Lotuses, they'll be rear-engined, powered by souped-up Fairlane mills. Likely drivers: Fireball Roberts and Fred Lorenzen, one-two finishers at Daytona on July 4.

The competition obviously is disturbed by the success of the Lotus-Fords. Novi Corp. vice-president Joe Granatelli—who just happened to field the three heaviest cars in this year's race, the supercharged Novis—proposed a 1,500-pound dry minimum weight limit for all

cars entered in USAC (United States Auto Club) championship events next year.

The Lotus-Ford weighs 1,130 pounds.

Push 'em back!

Drivers of Detroit-made cars will soon be sitting farther back from steering wheels that will be placed nearly vertical. This is a lesson Detroit is learning from foreign sports-car and formula racing. Most top racing drivers prefer to sit at arms' length from the wheel to allow their shoulders to assist in steering.

Disks again

Disk brakes are getting more and more attention in this country. Dunlop of England, producer of disks for Jaguar, Mercedes-Benz, and others, reportedly has an engineering task force in Buffalo, N.Y., working on disks for U.S. cars, presumably for aftermarket sale and installation.

Dayton Steel Foundry Co. also has a disk brake, which is undergoing tests by Ford Motor Co. for possible use on the Thunderbird and Continental.

More "puissant" Renault

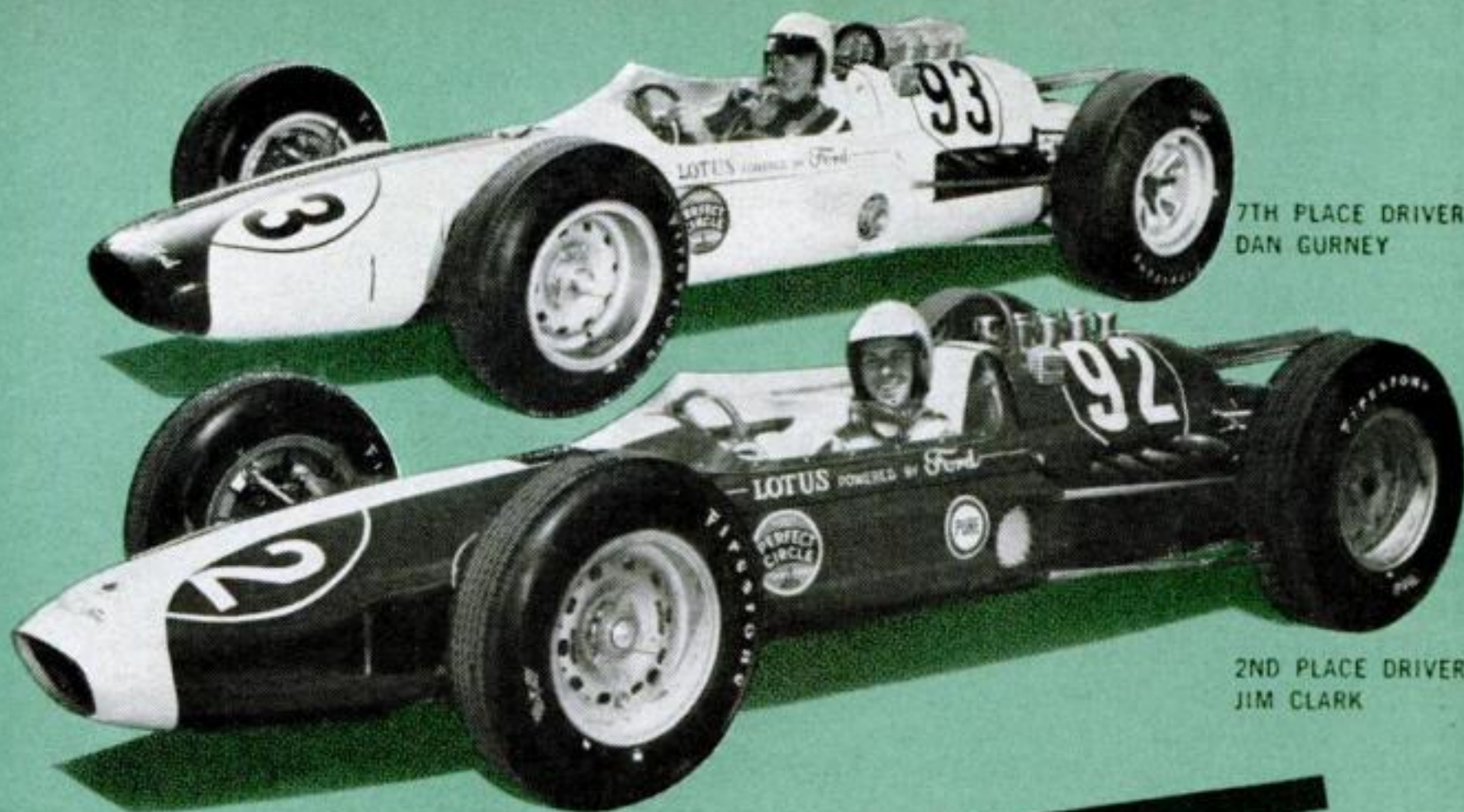
A slightly more powerful Renault R-8 will be introduced early next year. The new R-8 also will offer an optional push-button automatic transmission with magnetic clutch. Renault hopes these features will help end the company's tailspin in this country.

Manufacturers are going straight

Cars with curved side windows take in more water during a rainstorm with windows open, it has been found. Also, curved windows are harder to operate, especially when the car gets a little older. Lincoln has dropped curved windows for '64, and other manufacturers are going slow on them.

New attire for tires

Tire companies are experimenting with tires with built-in rims. Possible advantages would be lower cost and easier changing.



FORD-POWERED LOTUS CARS MAKE INDIANAPOLIS 500 HISTORY!

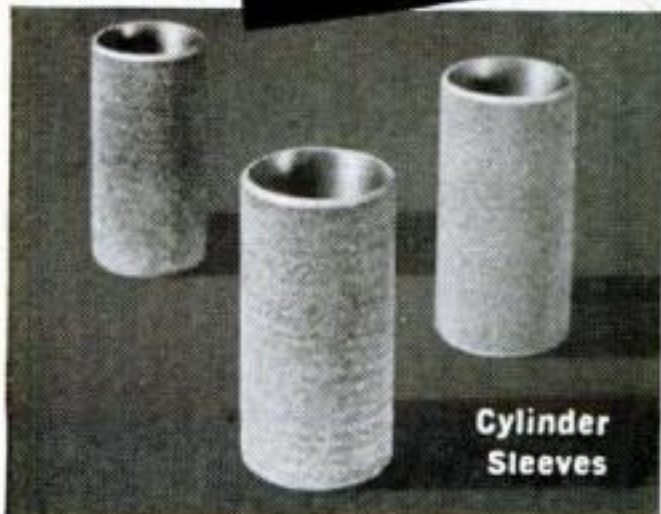
Competition in the Indianapolis "500" is as tough as it comes. That's why the designers of Ford's Fairlane V-8 high-powered engine were uncompromising in every detail. To get maximum power and endurance, they installed Perfect Circle chrome piston rings, valve seals and cylinder sleeves especially designed for Ford's sensational engine.

A look at the record shows that more than 80% of the Indianapolis winners since 1922 (including Parnelli Jones, 1963 winner) have used Perfect Circle piston rings!

PERFECT CIRCLE

Hagerstown, Indiana • Plants in Canada, Mexico, Australia, Argentina, Brazil and France

Piston Rings • Cylinder Liners • Precision Castings • Turbine Blades and Wheels • Electronic Programming Equipment • Speed Controls



Cylinder Sleeves



Piston Rings



Valve Seals

Popular Science *90, 60, and 30 years ago...*

1873 "The latest census gives a curious exhibit of the extent to which woman is now invading the provinces of industry. The 10 leading occupations in order are: agricultural laborers, teachers, cigar-makers, printers, midwives, barbers and hairdressers, physicians and surgeons, whitewashers, teamsters, brass-founders."

"Recently an electric light generated by a Gramme machine has been exhibited on the Victoria Tower of the Houses of Parliament in London. The machine is in the vaults of the House of Commons, and is worked by a small engine. Two copper wires lead from the machine to the base of the clock-tower and thence upward to the signalling point, a total length of nearly 900 feet—about three times the distance that an electric current has ever before been conducted for a similar purpose."

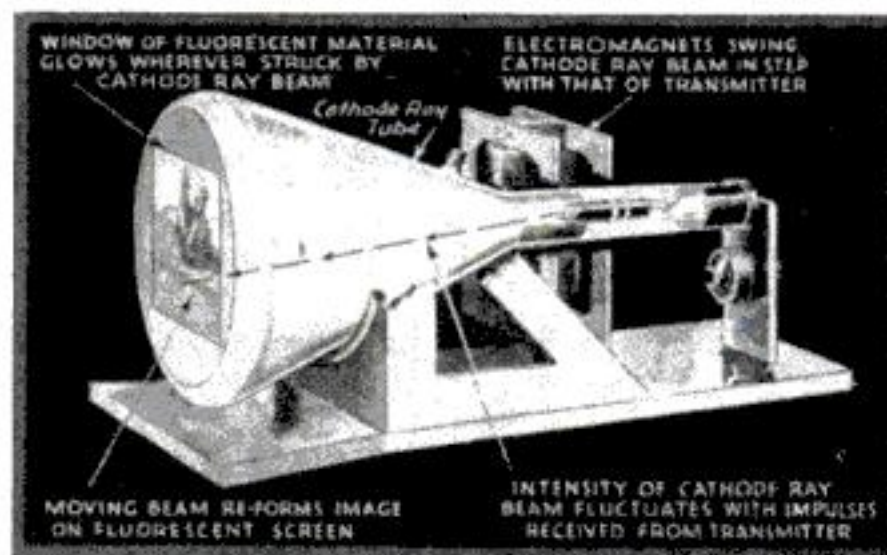
1903 "Within a few weeks of the present writing there have appeared newspaper accounts of the employment in the State Prison at Auburn, N.Y., of imprints both of the fingers and palms. The finger method, based upon the epidermic ridges of the fingertips, was devised by Mr. Francis Galton and has been proven statistically, with studies of identical twins, to establish identity with absolute certainty. Galton says that finger prints 'far transcend in trustworthiness any other evidence from any number of anthropometric data.'"

"Nearly all musical compositions have rhythms which fall between 65 and 80 beats a minute. This rhythm, for physical as well as psychological reasons, must, it is submitted, be regulated by the phenomenon of pulse. In support of this one may note that a rhythmic sound, call, or cry is first found coexistent with a complete circulatory system of heart, valves, and blood vessels. This first appears in the insect family. Further, when the insect's heartbeat is 150 to the minute, the insect's chirp runs to the same speed. So, it is suggested that when the human heartbeat is 60-85 to the minute,

human musical rhythms run within the same limit."

1933 "Testing the strength of radium and other materials, without exposing research workers to dangerous radiation, is made possible by an electrical hookup devised by government experts in Washington. The experimenter approaches the specimen only when placing it in or removing it from a small rack beneath a hollow metal chamber. Radium rays penetrate this 'ionization' chamber, and according to their strength, render the air more or less electrically conductive. The effect is registered, through vacuum tubes and an amplifier, upon a sensitive electric meter near the experimenter."

"What type of television receiver will be designed for home use? Dr. Vladimir Zworykin, whose 'iconoscope' promises to be the answer to television transmission, has also designed the 'kinescope' receiver. It employs a cathode-ray tube whose beam moves exactly in step with the transmitter. The beam's target is a window of fluorescent material that glows whenever the beam



strikes it. Thus the speeding beam retraces the image in highlights and shadows on the tube's window, its intensity corresponding to the radio impulses coming over the air.

"Sitting before the instrument, the owner will see a moving picture four by five inches in size (which may be magnified if desired) and he will watch far-away events as if he were there in person."

SCOUT is the registered trademark for a vehicle manufactured exclusively by International Harvester Company.



Running errands...



winching a boat...



taking the family...



plowing snow

If you don't own a SCOUT by INTERNATIONAL, you're not working as efficiently, or having as much fun, as you should.

The SCOUT is high enough off the ground so you don't get hung up in rough going. Rugged, reliable power—93 hp. comes from the 4-cylinder COMANCHE® engine. Regular gas only. All-wheel-drive (or rear-wheel-drive) gives it the

"go" you need, roads or no roads.

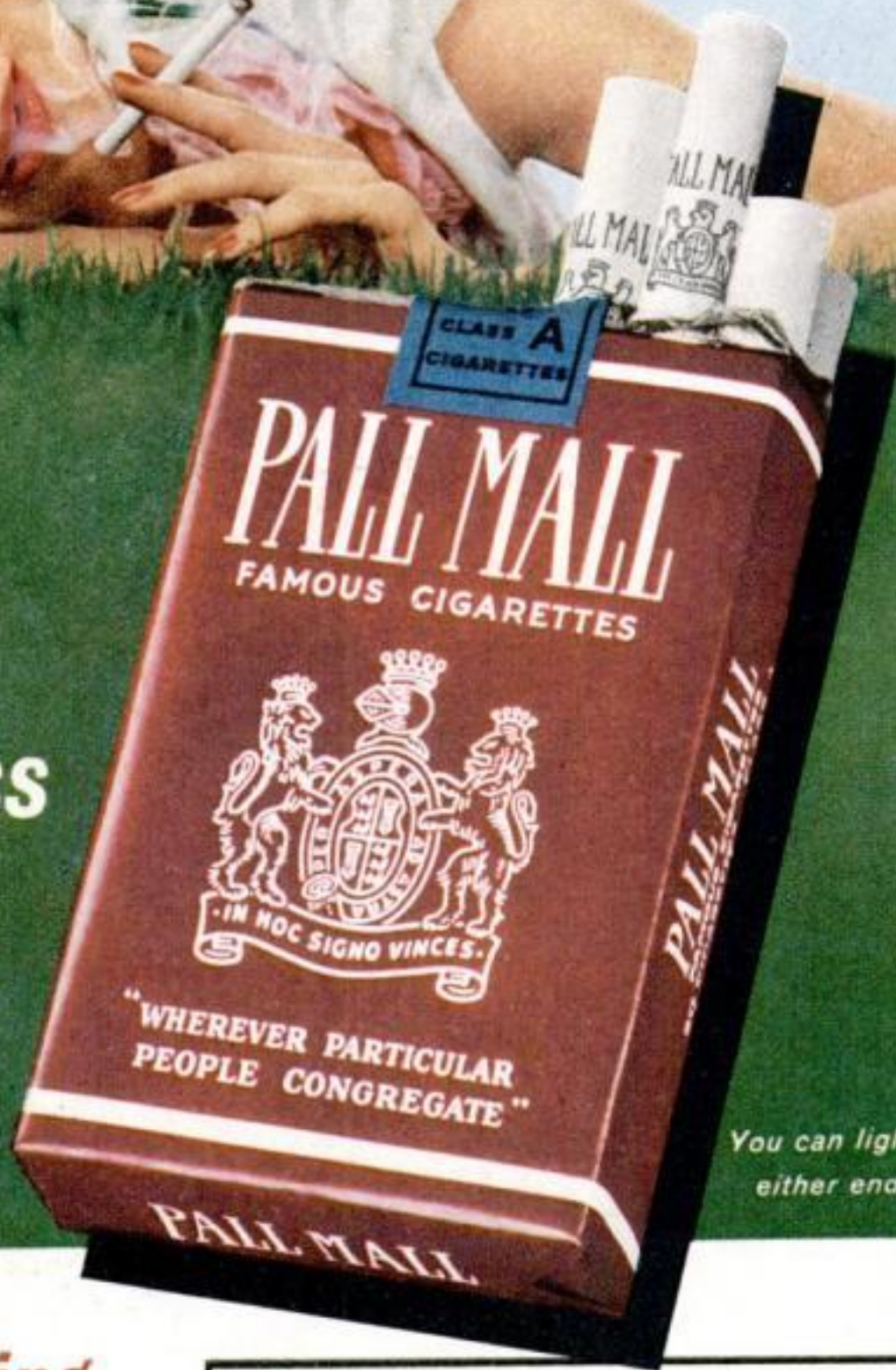
You can fit the SCOUT with a snow plow, power take-off, post hole digger, trailer hitch, any one of six tops (steel or vinyl), even bucket seats and a full-width removable back seat.

How's that for a vehicle that'll also winch a boat out of water? See the SCOUT at an INTERNATIONAL Dealer or Branch.

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Scout®
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**Pall Mall's
natural mildness
is so good
to your taste!**



*You can light
either end!*

**So smooth, so satisfying,
so downright smokeable!**

For flavor and enjoyment you just can't beat Pall Mall's natural mildness. It's so good to your taste. Never too strong. Never too weak. Always just right! Enjoy satisfying flavor... so friendly to your taste.

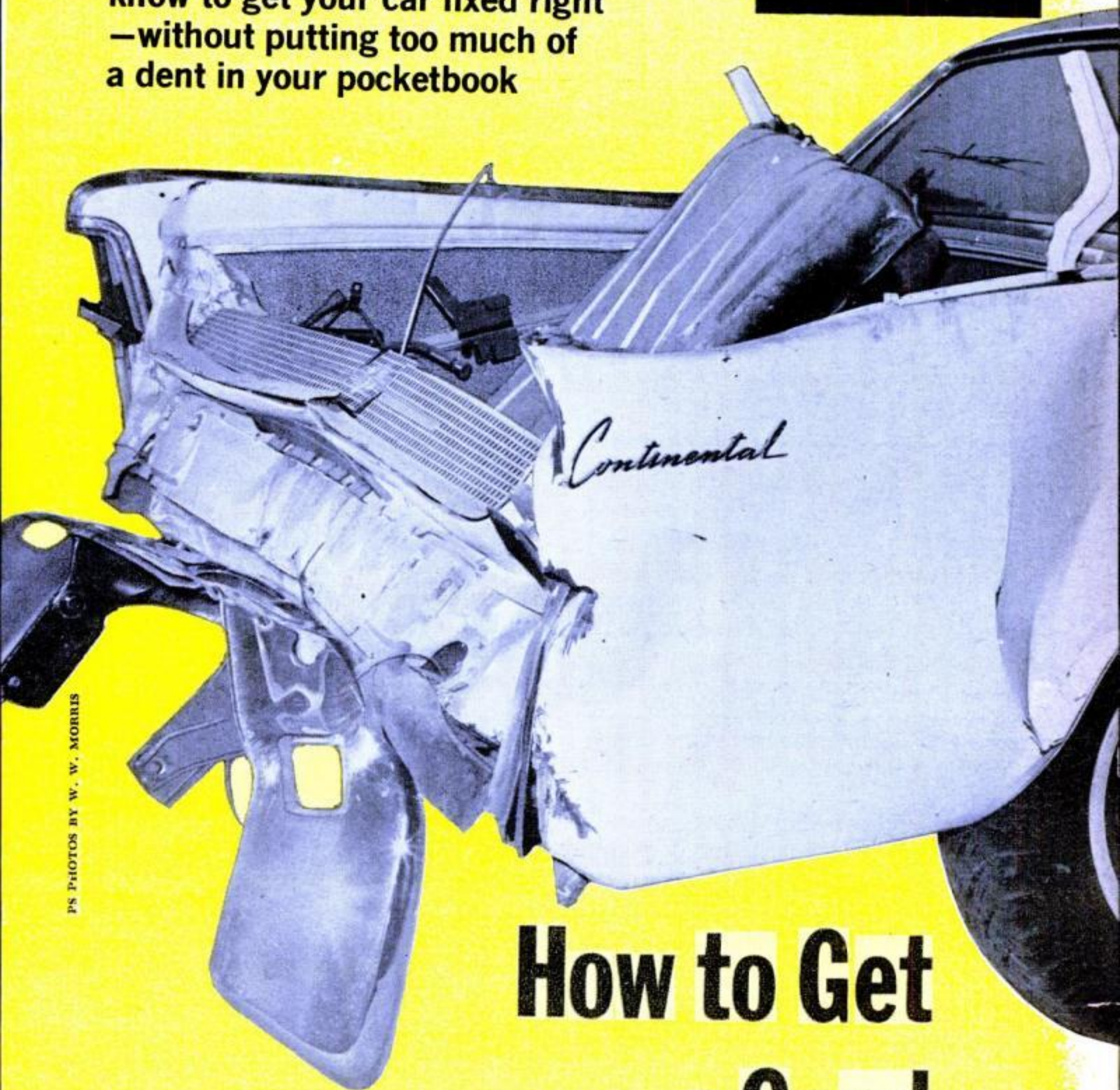
Outstanding... and they are Mild!

COMPARE ALL THREE!



Smoke "traveled" through fine tobacco tastes best. Pall Mall's famous length travels the smoke naturally... over, under, around and through the finest tobaccos money can buy. Makes it mild... but does not filter out that satisfying flavor!

Here's what you need to
know to get your car fixed right
—without putting too much of
a dent in your pocketbook



PS PHOTOS BY W. W. MORRIS

How to Get a Good Body-Repair Job



This was the accident repair job. But what would it cost?

After runaway compressor clobbered his car, author looks back at badly creased door and panel.

Slicing it like butter, a body expert cuts off panel with air chisel in Anthony Gross's shop.

By E. D. Fales Jr.

THE body-shop man looked at my smashed car. "I reckon I can fix it for \$75," he said. But I wondered—because I'd just had an estimate from another shop for \$172.

What should you do in a case like that?

My car was a brand-new wagon. A runaway air compressor had come thundering downhill and smashed my left rear door and fender.

You know the feeling. Sure, it will be fixed. Sure, the insurance company will pay. But will your car ever look as good again? Will you end up driving a patched-up cripple?

To make matters worse, I began hearing stories:

On a Western road, a man hit (and killed) a big deer. He pulled into a town, waited two days while a new fender was installed—for \$97. That was six months ago. Today the paint is falling off that fender in chunks. I know, because I saw it.

In the East, a driver paid \$50 to get "body cancer" cut out and healed—just ahead of his rear fender. Three months later *that* job fell apart.

Near Wilmington, Del., a driver side-swiped a pole, bought two new fenders.

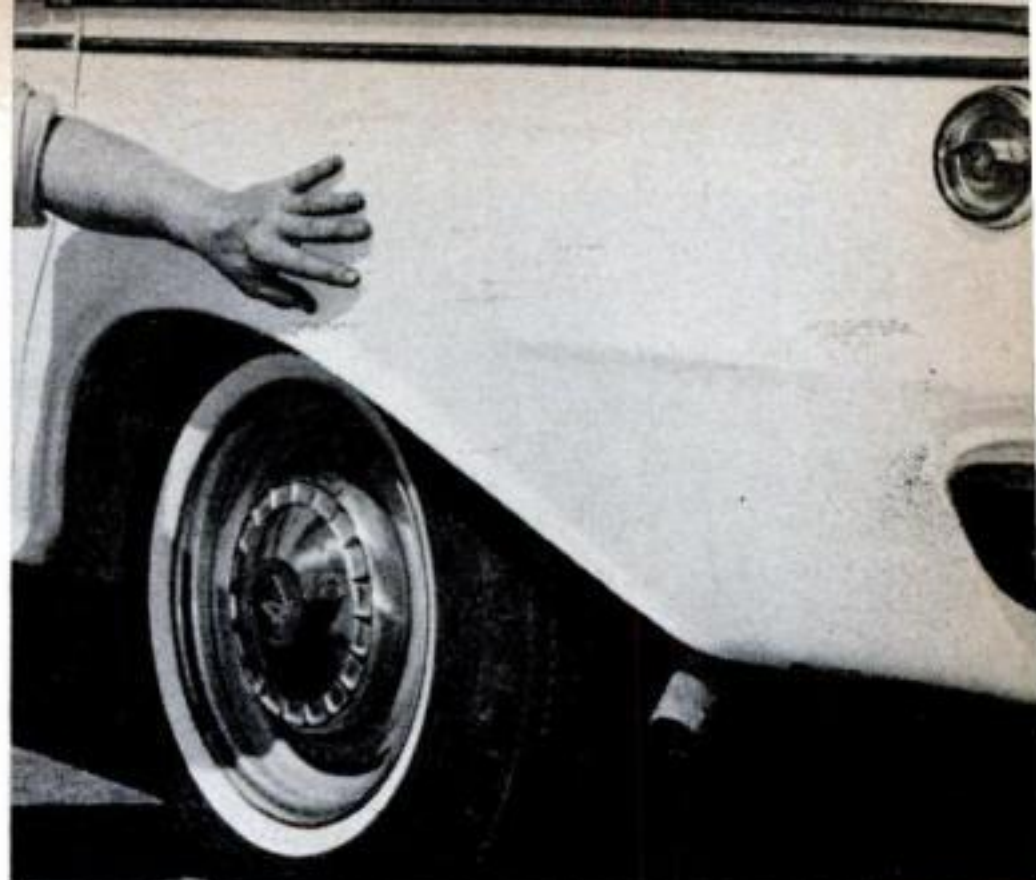
Two months later one of those supposedly "new" fenders rusted clear through.

Then there was a Continental owner. He got rammed. Damage: \$1,000, insured. The shop tied up his car for six weeks. When he got it back, it looked as if it had tired blood. It drooped, the paint was bad, the doors hung limp, plastic dust hadn't even been cleaned from the seats. The shop owner shrugged. So did the insurance man. "You signed a release," he said, "to get the money to get the car repaired."

You're going to need a body job soon (the statistics say within four years at most); everybody's getting hit on today's overcrowded roads. (In 10 years, by one estimate, 180,000,000 fenders will be dented.)

How do you stay out of trouble? How do you get a "right" job? Whom do you pick: the \$75 guy (who seemed honest) or the \$172 guy? I was suspicious of the \$172 guy because I'd seen him write up some fake items, including a new bumper (mine was perfect). "You're insured, of course," he smiled. Then he stuffed the estimate in an envelope and handed it over without letting me read it. "Just give this to your insurance man."

Does this mean you choose the \$75 guy?



... And how do you get a job as slick as this?

Foreman inspects cut where new panel must be joined, checks for wheel-well damage.

Finished job, carefully welded and painted, was moderate in cost, far less than top estimates.

I told the editors of POPULAR SCIENCE about my dilemma. They said: "Look, everybody who gets hit worries about getting a good body job, but nobody has any ground rules to go by. Go out and get some more estimates. Find out why prices differ. Then talk to a lot of body-shop men—anywhere you find them. And come back with some ground rules."

So I went out and drove 1,000 miles in four states. I interviewed body men in gas stations, garages, dealerships, warehouses, an old Quonset hut, and even a basement in Maryland that looked like part of an unfinished church.

And I came back with rules—and estimates up to \$218.

Know what to look for. The man who gets the best job is usually the driver who knows what good work is. "Nine out of ten don't," some shop men said. "They just come in and say: 'fix it.' They don't know whether we're going to use welds or screws, whether we're going to straighten the frame—or shim out some parts with washers. They don't know if we'll straighten a panel or plug it with filler, or whether we'll overlook damage underneath that they'll never see. And they *never* ask: how many coats of paint?"

Get what you pay for. It's fatal not to

care what a job costs—just because it's insured. "Honesty is contagious—and so is dishonesty," a shop man on U.S. 1 said. "If you don't care when a shop pads your bill to fool the insurance company, the shop man may decide to fool you, too."

And there are dozens of ways to fool you. One example: You pay for a new fender but get a used one—or even your own old fender patched and straightened. Or you pay for a good weld job—and get a quickie tack-weld—merely a few scattered weld spots.

In a bustling car-repair section of New York City's Bronx I met Paul Pearl, a good body man. He runs a busy place called Paul's Body & Fender Repairs. Pearl said, "A shop that wants to can hang anything on you. Look over there."

He pointed to a blue Tempest.

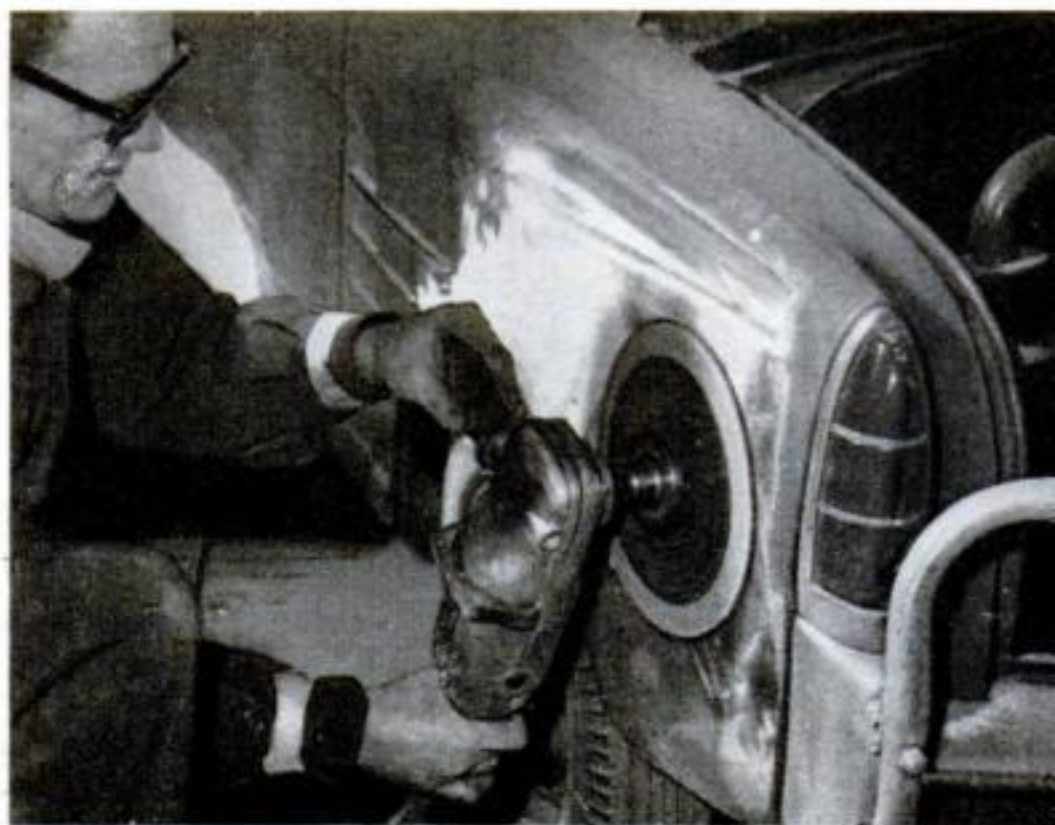
"That man had a slight tangle," Pearl said. "Door smashed. He went to a dealer because he thought he'd get a good job. He didn't know that a lot of dealers just pass the work on to body shops."

The whole outer panel was lying on the floor. Pearl picked it up and counted six tiny tack-weld spots. "That's all that was holding the panel on. It wasn't fastened at all. Today he got hit again. Just a tap. And the whole panel fell off."

Craftsmen show what happens when your car is being fixed



This skilled body man is hammering out dents against metal dolly. He'll also weld the cuts. Others take shortcuts, merely load on gobs of plastic filler much too thick to hold for long.



In hands of a good craftsman, grinding disk not only gets down to bare metal but replaces file, smooths out metal without leaving circular grinding marks to show through paint.

Now he's brought it to us to fix it right."

Dishonesty doesn't pay. In shop after shop, the first question asked is: "Are you insured?" Many shops, including the best, play a game with insurance companies. "We always add \$30-\$50 to average (\$100-\$200) jobs, just so the adjuster can knock it off and please his company," one body man said. (Hence if you're not insured, be sure to say so—and be sure the price given you does not include this padding.)

Some shops frankly try to overcharge the insurance companies. "We can fix up a dent on the other side for you and charge it up to this job," one man offered.

If any attempt is made to fake your bill and fool the insurance company, fight it. Those padded bills are one reason your premiums are high. You're paying fake claims for all those other drivers.

Take notes. After a crash, make a record of what's smashed and what isn't. Reason: Some shops have been known to smash things up more—or charge you for repairs that weren't needed or made. If in doubt, pay a trusted mechanic \$10 to come see your car.

Be on guard when you're traveling. Some shops prey on tourists. One body man said frankly: "We love 'em because we'll never see 'em again. We load it on."

There are several ways to load it on: To get you in, one shop writes a bargain price—say, \$100. When you come for your car, you're told, "We had a lot of trouble. The bill's \$175." You squawk. Then they show you a small printed line on the estimate that says: "Prices not guaranteed."

In a reputable shop, that line means that any increase in parts cost may sometimes (not always) be added on. In a gyp shop it can mean anything.

"If you won't pay," one man said, "the law lets us shut the shop doors and hold your car." One tip: If you're touring, pay for temporary repairs only—just enough to get home.

Use a work order. Your protection anywhere is to sign a work authorization. Specify exactly what you want done. That limits the work that can be charged to you and requires the shop to notify you if added repairs are needed. You don't have to accept the shop's

[Continued on page 206]



To cover small scratches, this mechanic is applying a thin coat of plastic filler. Some good body men insist that plastic usually should not be more than $\frac{1}{8}$ or $\frac{1}{16}$ of an inch thick.



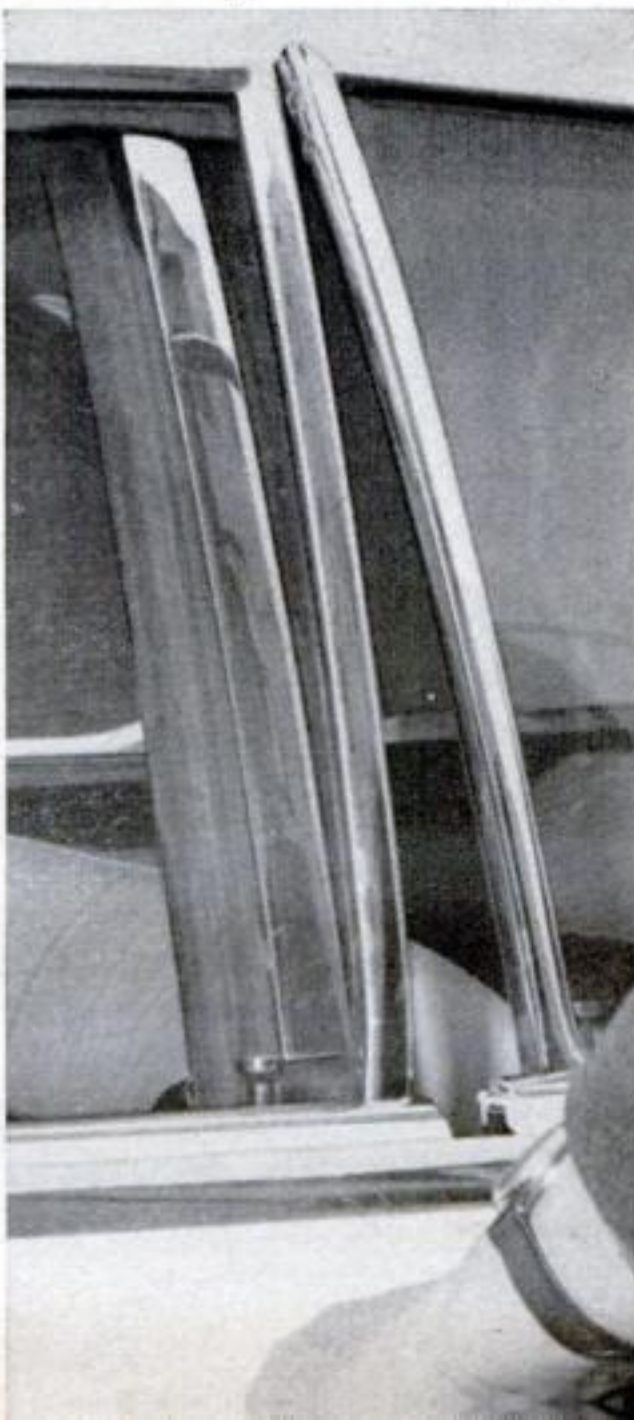
Compounding is a job that's often slighted. This man is buffing a new paint job to "rub out" the finish and put sparkle in it. This also removes tiny and unsightly "orange-peel" wrinkles.

Look out for these troubles when you get your car back

Ragged metal edges where right rear door of car was repaired are a sign of sloppy body repairing.



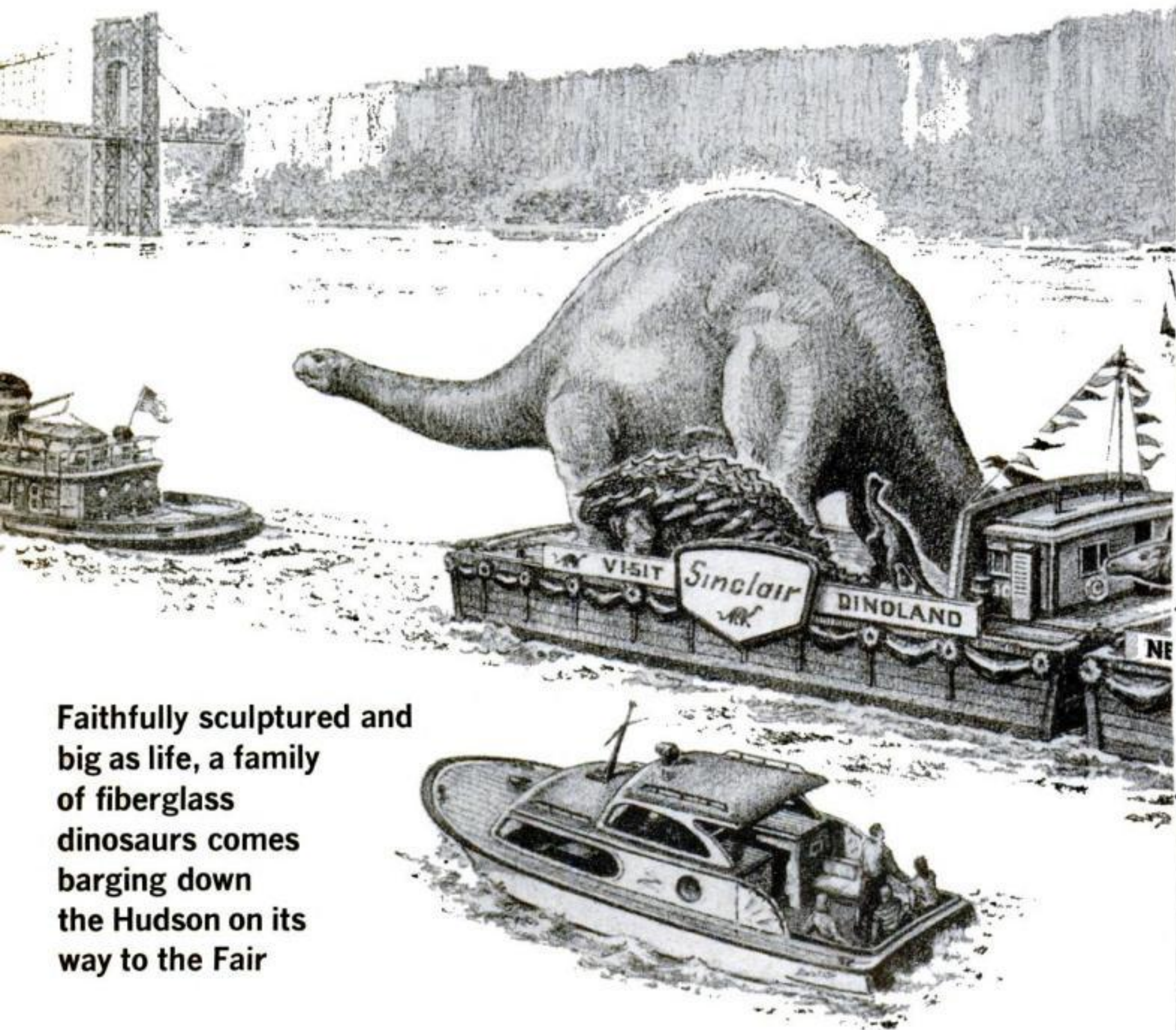
Crooked doors cause windows to bump together at top. This poor work was part of a repair job that cost the disgusted owner \$1,000.



Poor preparation for paint job caused paint to flake off eight months later. Honest shop agreed to do job over.



Getting There Is



Faithfully sculptured and big as life, a family of fiberglass dinosaurs comes barging down the Hudson on its way to the Fair

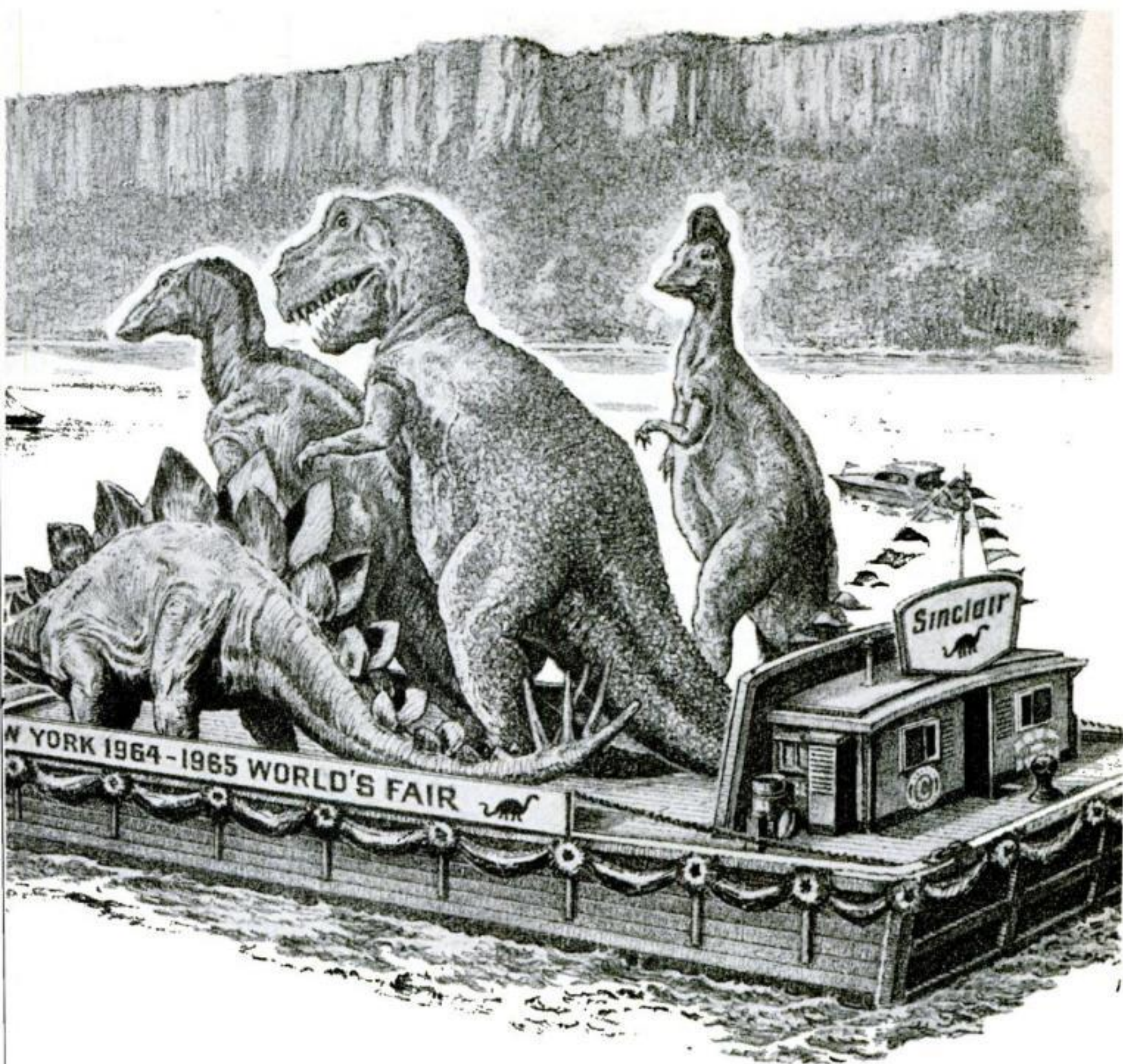
Drawings and Text by Henry B. Comstock

FOR the first time in 70 million years a herd of dinosaurs will travel down the Hudson River this month. Hatched in the Catskill Mountains, nine of the giant lizards will migrate to a prehistoric paradise in the New York borough of Queens. There they'll spend the

next two years, wallowing in Mesozoic foliage and lava-lipped lagoons. Eight of the monsters will make the 140-mile trip by barge. The ninth will fly—dangling from a helicopter.

All this is part of Sinclair Refining Company's Dinoland exhibit at the '64-

Half the Fun



'65 New York World's Fair. A year ago, Sinclair, which has long used a brontosaurus as its trademark, went into a huddle with famed animal sculptor Louis Paul Jonas. Out of that conference in his Hudson, N. Y., studios came a tough, \$250,000 assignment. Jonas was commissioned to re-create the monsters who roamed the earth back in the days when

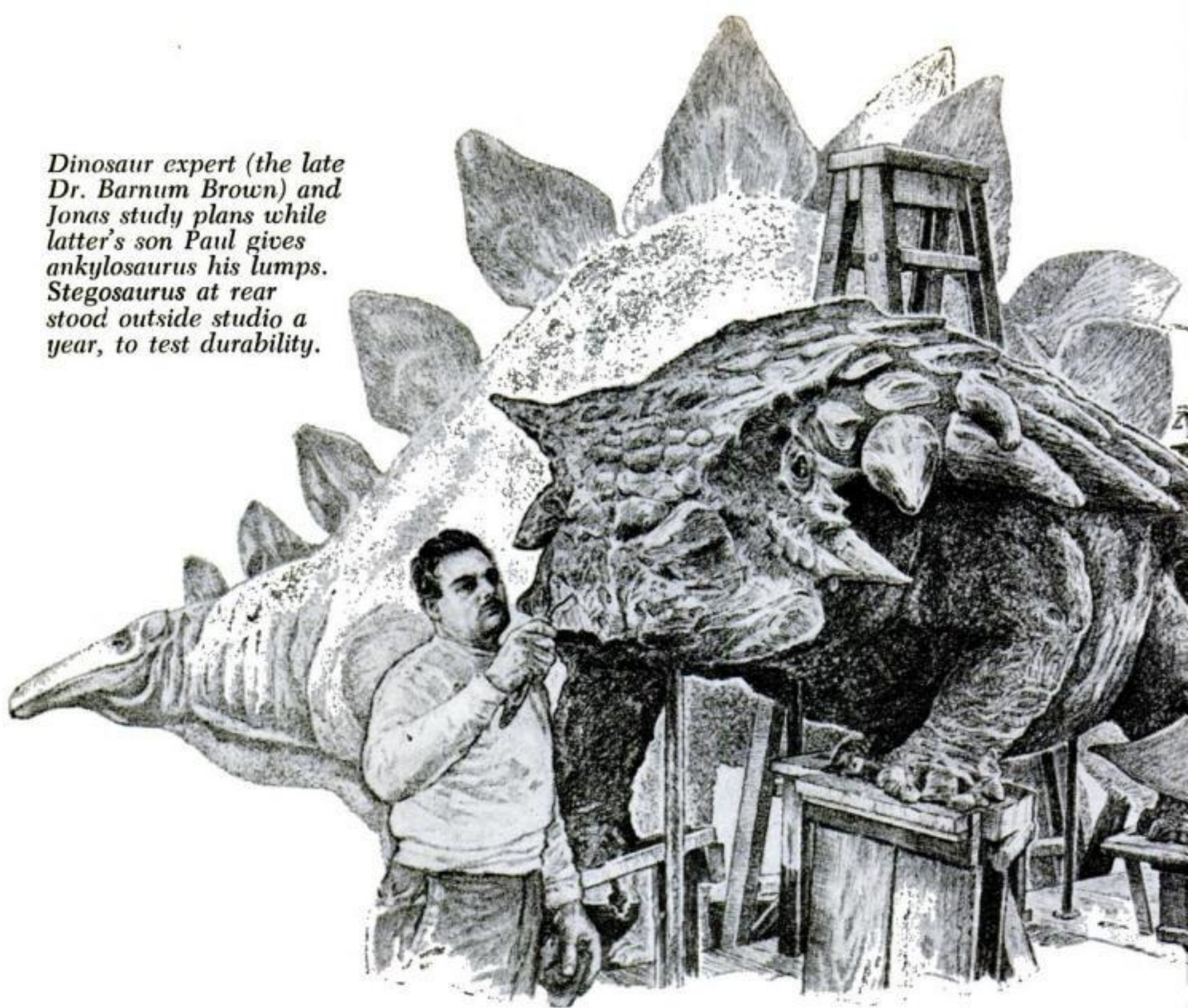
the stuff in your carburetor was just beginning to brew.

These are no slap-dash amusement park creatures. Jonas was determined to make them as scientifically accurate as possible. He was convinced that fiberglass was the answer.

Two months later, Jonas and his staff of 18 skilled assistants completed their

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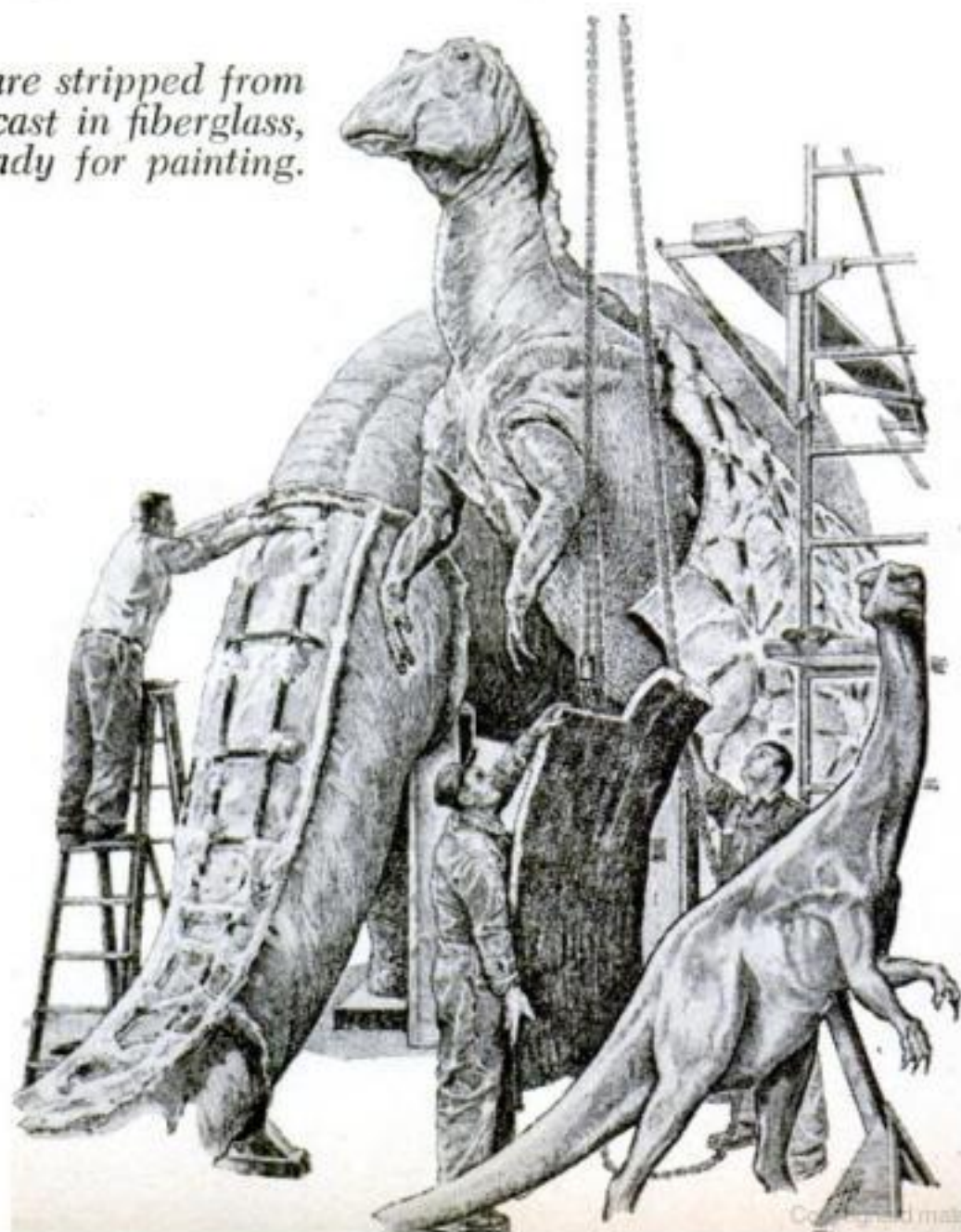
Dinosaur expert (the late Dr. Barnum Brown) and Jonas study plans while latter's son Paul gives ankylosaurus his lumps. Stegosaurus at rear stood outside studio a year, to test durability.



Burlap-and-pipe-reinforced plaster molds are stripped from clay brontosaurus and trachodon. Already cast in fiberglass, ostrich-size ornithomimus is ready for painting.

first plastic creation—a giant stegosaurus.

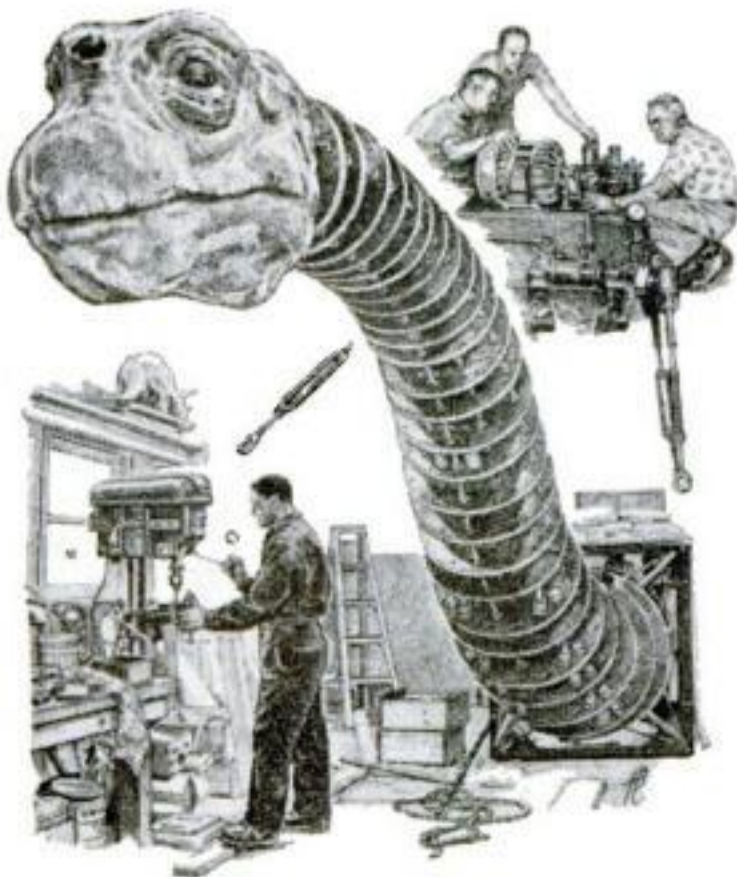
The casting system for the other eight dinosaurs soon became routine. First, a small pilot model. Then a wire-mesh-covered plywood armature for a full-scale model. Over that went plasticene. Painstakingly shaped and surfaced, these works of art were next crisscrossed with steel shims, to dike off areas for multi-section molds. A coat of air-gunned plaster was followed by many brushed-on layers. The plastic parts were fitted together, bonded with more resin and glass cloth. Result: Even with an internal steel frame, the mighty brontosaurus weighs a scant five tons.



Sculptor Louis Paul Jonas first modeled tyrannosaurus and other dinosaurs in miniature, later sliced them like loaves of bread to develop templates for full-scale patterns.



New York cliff dwellers will do a doubletake as one monster—reportedly triceratops—is wafted to the Fair by chopper.



Electrically controlled hydraulic cylinders will put brontosaurus neck through lifelike contortions. Since sketch was made, plywood disks have been covered with a latex sleeve.





***FROM
TRACK
TO
TURNPIKE***

PHOTO BY TAYLOR WARREN

Skid row

Parnelli Jones' Merc broadsides to a screaming stop after 1963 Indy champ "lost it" during Atlanta 500 practice last March. Standing nearby, Editor Bob Crossley, almost scared out of his shoes, snapped Jones' shoes (right) minutes later.



By Devon Francis

ON THE 95th lap of the world's most famous oval-track race—the Indianapolis "500"—last Memorial Day, Jimmy Clark rolled in for his first pit stop. He was driving one of two Ford-powered Lotus mounts. As always, split seconds counted.

Steve Petrasek, Firestone's bouncy, brush-cut manager of race-tire engineering, measured the tread wear in a trice. The left front tire looked good. The other three were replaced.

"Will they go all the way now?" anx-

iously inquired Colin Chapman, the car's British designer. Avoiding another pit stop would save 20-odd seconds, or almost half a lap, on the 2½-mile track.

"Yes," said Petrasek.

And he was right. Clark's first pit stop was his only one. When the race was over, with his Lotus in second place, he had plenty of rubber left all around.

Being right was what Petrasek was paid for. He knew his tires. He knew the car. He knew Clark's driving habits. He also knew that from that race, and hundreds of others, his company's laboratories were learning how to make

CONTINUED

Pre-race briefing on tires by Firestone's Steve Petrasek is required for rookie drivers like Art Malone (in T-shirt), but veterans Bob Christie and Parnelli Jones (left), 1963 winner, listen in for a refresher. Drivers must know usual wear sequences of tires in races: right front, right rear, left rear, left front. On rear-engine cars such as Indy Lotus-Fords, the right rear tire sometimes wears faster than the right front.



Different cars, track surfaces, and weather conditions call



Opening in floorboard allows stock-car driver to check tire wear during race. Trap door keeps dust out of the cockpit.



Asphalt-racing tire has tie bars $\frac{1}{32}$ inch below surface to make tread almost solid as it wears down. Otherwise, tread would tend to feather in one direction as it wore, losing traction.

better tires for tens of millions of U. S. motorists—safer, longer-wearing tires.

The tires you roll on today are good for several thousand miles more than those of a decade ago, thanks to the lessons learned from championship-class races such as the Indy, in stock-car races on dirt and asphalt tracks, and in sports-car road races.

Life expectancy: 500 miles. The race tracks, where speeds are limited as much by tires as by engines, are field laboratories. Tire engineers, drivers, and mechanics figure that tire wear—even on a “perfect” track such as Bill France’s high-banked Daytona Beach oval where the classic Daytona 500 stock-car race is run every February—is 50 times greater than that experienced by the ordinary motorist. To them, 500 miles is equal to 25,000.

Firestone and Goodyear alone do race-track research on tires. The questions that drivers and pit crews pose for engineers of the two companies follow much the same pattern.

In this year’s World 600 at Charlotte,

N. C., Fred Lorenzen, driving a stock Ford shod with Goodyears, rolled into the pits at 100 miles for his first tire change. This track measures only $1\frac{1}{2}$ miles, and stock cars, weighing over a ton more than Indianapolis-type mounts, usually require replacement of the right-hand tires each 100 miles. The heavy wear occurs on the right side because the cars travel counterclockwise.

The tread on Lorenzen’s left-side tires looked good for 300 miles. The question was, could the right-side tires, if changed at 100 and 200 miles, then be stretched an extra 100—to the 400-mile mark? If only the left-side tires were changed at 300, it would save 15 to 20 seconds.

Elmer Wasko, Goodyear’s shrewd chief racing-tire engineer, advised the pit crew, “It’s worth the chance.”

The tires stood up. Lorenzen won.

The lessons. What is racing teaching the tire companies that can be used in the manufacture of regular passenger-car shoes? Rubber “compounding”—the engineering of the beads where the tire

for different tires—and there's a tire to meet every need



Open, directional tread characterizes dirt-track tire. Rubber is softer, too. All racing tires use tubes as a safety measure—to retain more air (and therefore control) in case of an accident.



Measuring tire temperatures: Ed Long of Goodyear checks a tire at Daytona with a short needle and a thermocouple.

mates with the rim—and the design of the fabric (or carcass) and of the tread.

In racing, all this is a close-kept secret. Firestone and Goodyear formulas are kept under lock and key in Akron, home base of the rubber industry. But the ultimate results in standard passenger-car tires yield to laboratory analysis, and tire manufacturers not engaged in racing also benefit.

The tire you buy from your dealer is a simple product only in appearance. A dozen different chemicals have been poured into it. Activators, for example, trigger the curing of the raw rubber. Carbon black contributes abrasion resistance and adhesion to the road, as well as wearing qualities, and helps bond the materials.

Clusters of wires, like a laced cable, lend rigidity to the beads and prevent the escape of air from tubeless tires in turns so hard that the profile of the tire visibly distorts. The fabric is the tire structure, much what a frame is to a house. The tread is there to grip the road.

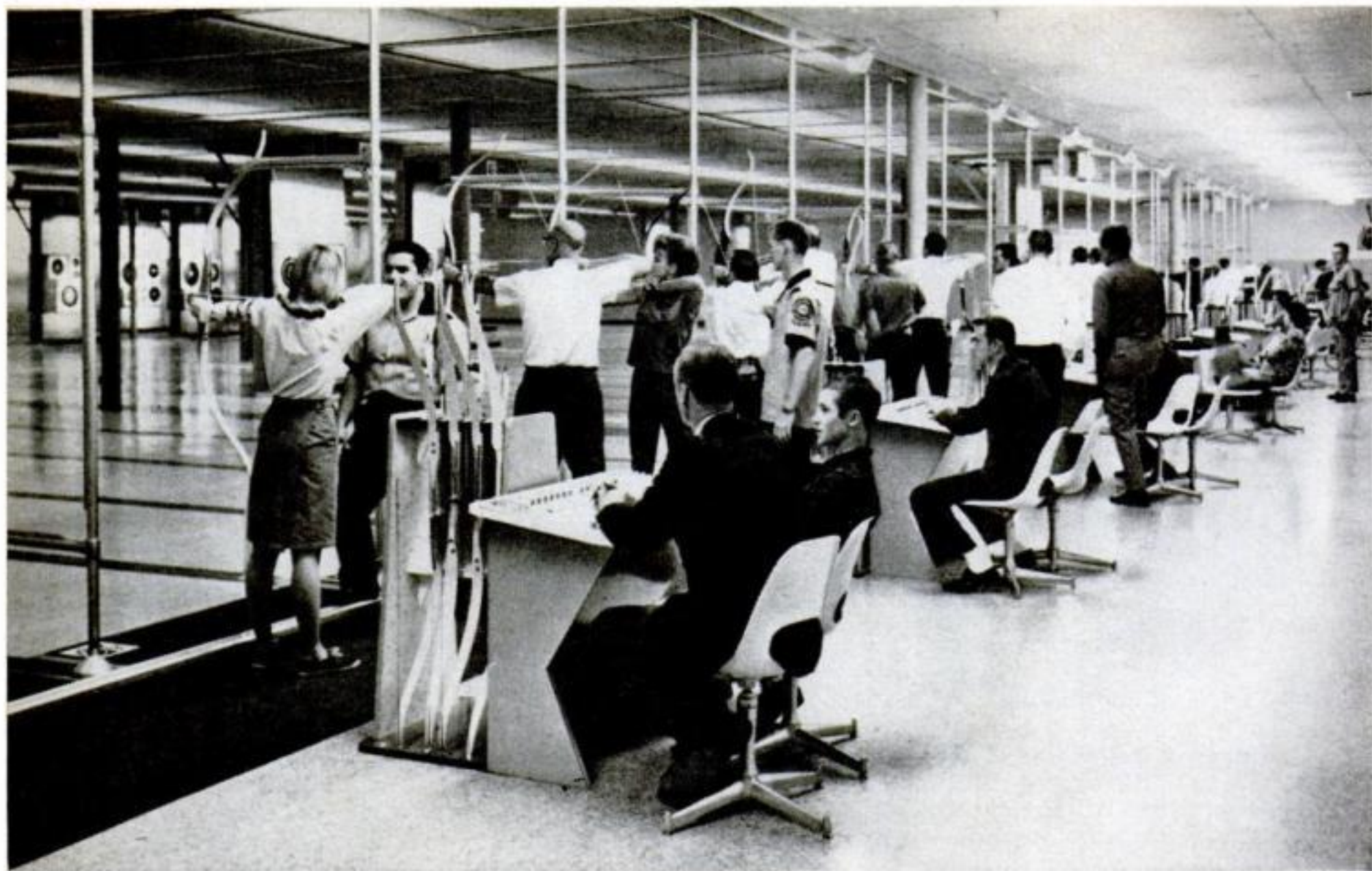
Hard vs. soft rubber. It is on the rubber compounding and the design of the fabric that most of the care is lavished, in both racing and turnpike tires. The rubber (mostly artificial these days in turnpike tires) can vary in softness. A soft compound adheres to the road better, but usually wears faster.

Chapman's three cars for the Indianapolis 500—one cracked up in the time trials, two competed—arrived from England shod with Dunlops. The softness of the compounding gave bad wear. Chapman switched to Firestones.

Yet soft rubber has its place. The Firestone tread rubber on the left side of the winning car in the Daytona 500 last February, driven by Tiny Lund, was similar to that used by the company in its standard passenger-car tires. It let Lund take the turns faster—and it went the whole distance, as did the rubber on the right side, which was tougher, for wear.

Compounds differ within the tire itself.

[\[Continued on page 198\]](#)



Competing archery teams line up here in a 24-lane installation at Downey, Calif. Table in

foreground is console for operating target. Units are in Pacific Coast and Midwest cities.

Now the targets come to the marksmen

Archery and trapshooting are going indoors and becoming automatic. Result: more fun and less work. West Coast Engineering, Seattle, makes lanes, somewhat like bowling alleys, for both. Now in many cities in the West, they will soon be in the East. Makers of the automatic archery equipment expect to open 100 lanes this year. With 20,000,000 hunters in the land, they say the traps will take hold even faster. Archers no longer need walk to targets to check scores and retrieve arrows. At the press of

a button, the target comes to them. A brush at its front lets down to sweep back to the bowman any arrows that have fallen short. If the archer wants to try his luck at varying ranges, he has a choice of six positions to which the target can be made to travel.

Automated trapshooting is even newer. Emphasis is all on the fun of shooting, the drudgery is taken care of by machines. Shooters stand in separate, glass-walled booths, leaning against a switch that starts



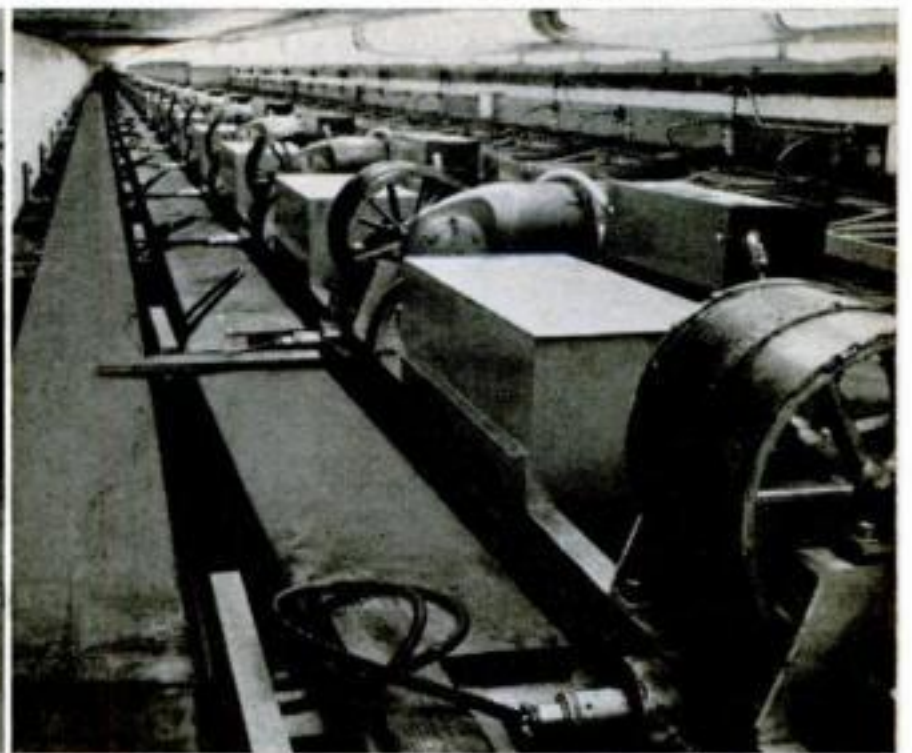
Helicopter sprouts wings

With a short running takeoff, the hybrid at left can get off the ground with heavier loads than those managed by a pure helicopter.

Bell built the experimental Wing Ding for research into extending helicopter capabilities and vertical and short takeoffs and landings. The rotor mast's angle can be varied in the air for flying or hovering.



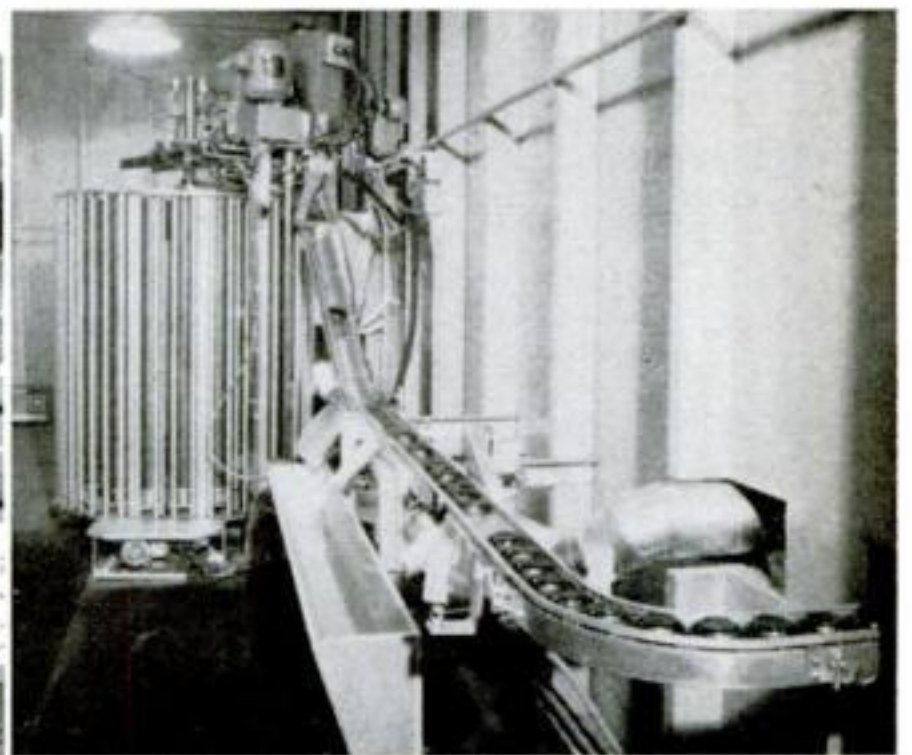
Archery targets, illuminated by spotlights, travel on overhead rails. They can be moved by pushbutton to distances of 20 feet to 30 yards. Glass barriers separate shooting positions.



Overhead cable drums move targets in gallery. Switching unit controls the drive motor for each, disconnecting power and applying a brake when target nears its desired position.



Clay pigeons are ejected from pocket below booth. You have the fun; machinery does the work. Murals and shrubbery simulate outdoors. First glass-enclosed Trapomatic was in Denver.



Stacks of 3,400 clay pigeons are at rear of conveyor that feeds ejection guns beyond partition. Birds are blown along by pumped air, faulty ones fall off into trough at left.

clay pigeons flying downrange. They can set the pneumatic ejector to hurl a bird whenever the switch is touched, or toss out

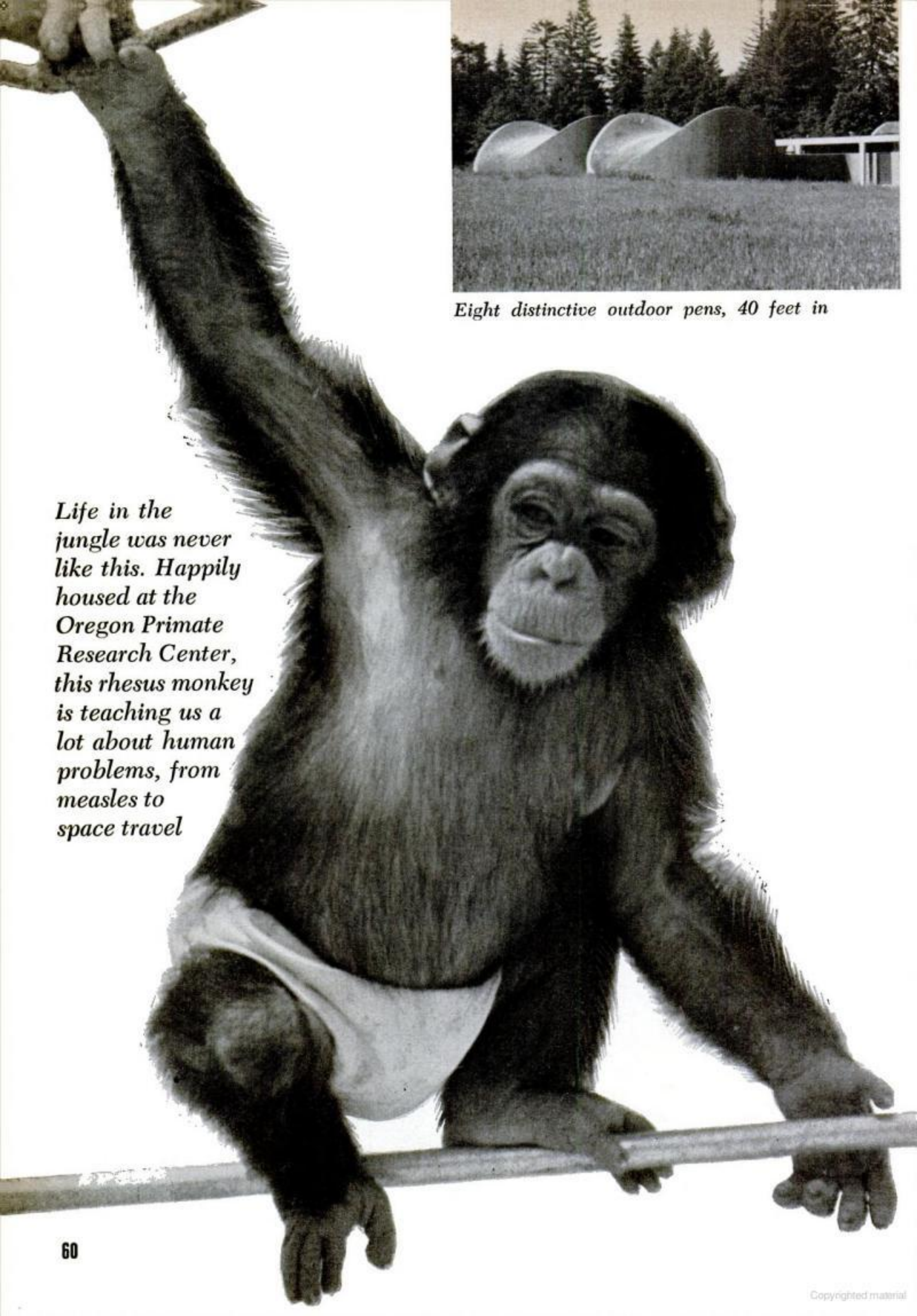
a string of 10 at three-second intervals; and can make them fly straight or in different directions and at different angles.

Throwaway paper rain shield

A corrugated-paperboard canopy now keeps rain from running down your windshield and distorting the screen image at drive-in movies.

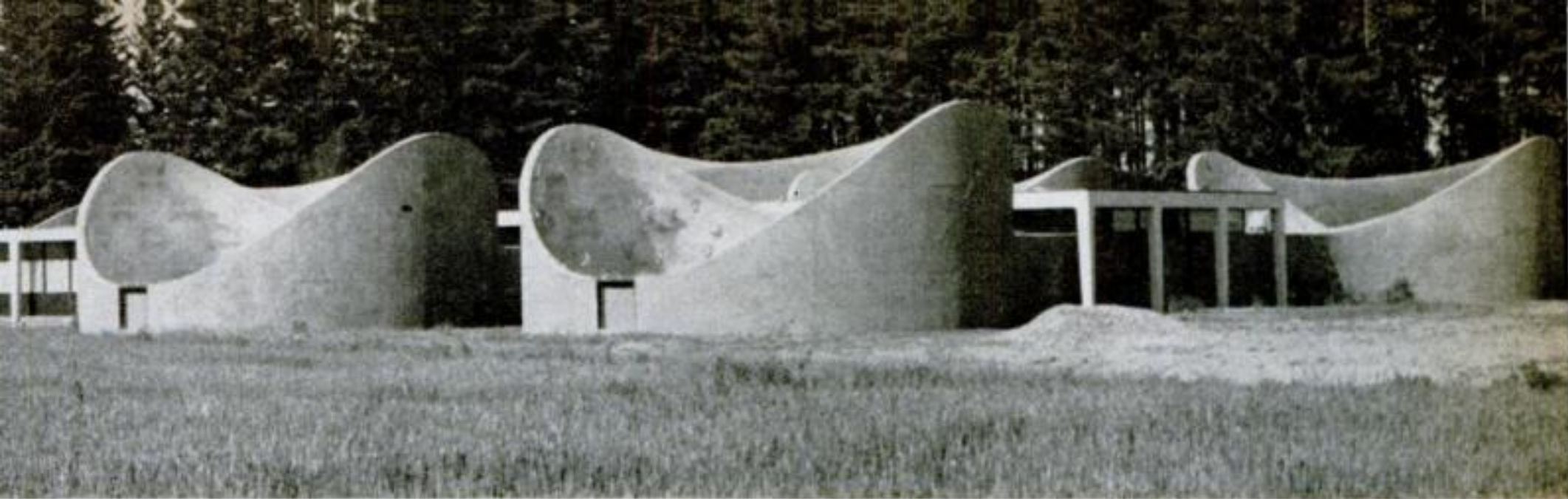
Olin Mathieson designers developed it as a cheap substitute for rental metal and plastic shields. There's no bother of return, and the water-repellent paper can be used several times if not exposed to a hard rain.





Eight distinctive outdoor pens, 40 feet in

Life in the jungle was never like this. Happily housed at the Oregon Primate Research Center, this rhesus monkey is teaching us a lot about human problems, from measles to space travel



diameter, surround the 250-foot-long building where Center's hundreds of monkeys live.

Monkey Business in Oregon

By Jack B. Kemmerer

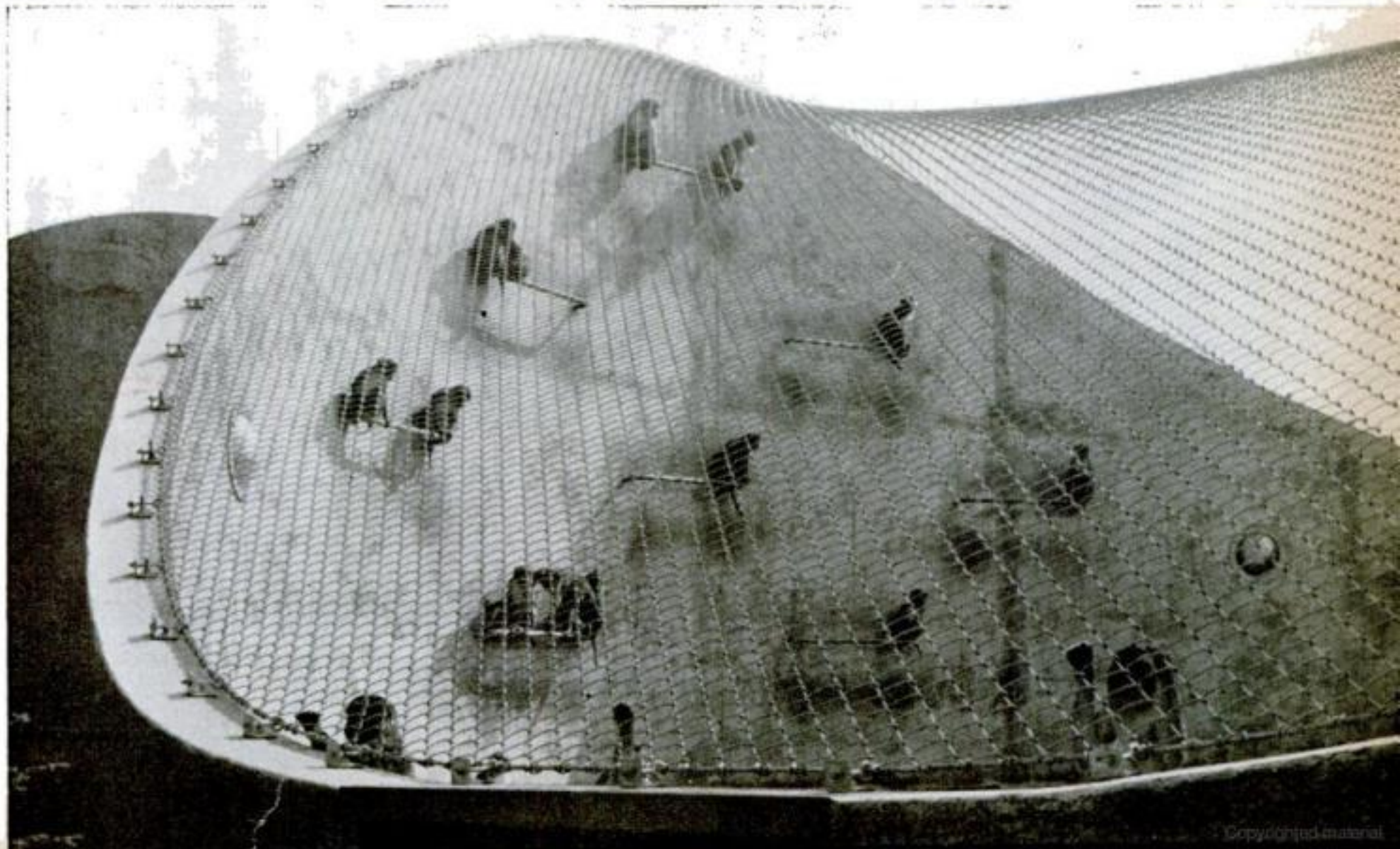
ON A pine-scented spread of 200 acres near Portland, Ore., several hundred rhesus monkeys are giving scientists a hand.

These monkeys are but a small colony

of the 200,000 imported into the U. S. last year, mostly from India, for medical research. Some of them were born where they now live, in the nourishing confines of the unique, federally sponsored Oregon Primate Research Center. They're all so healthy that newcomers from the

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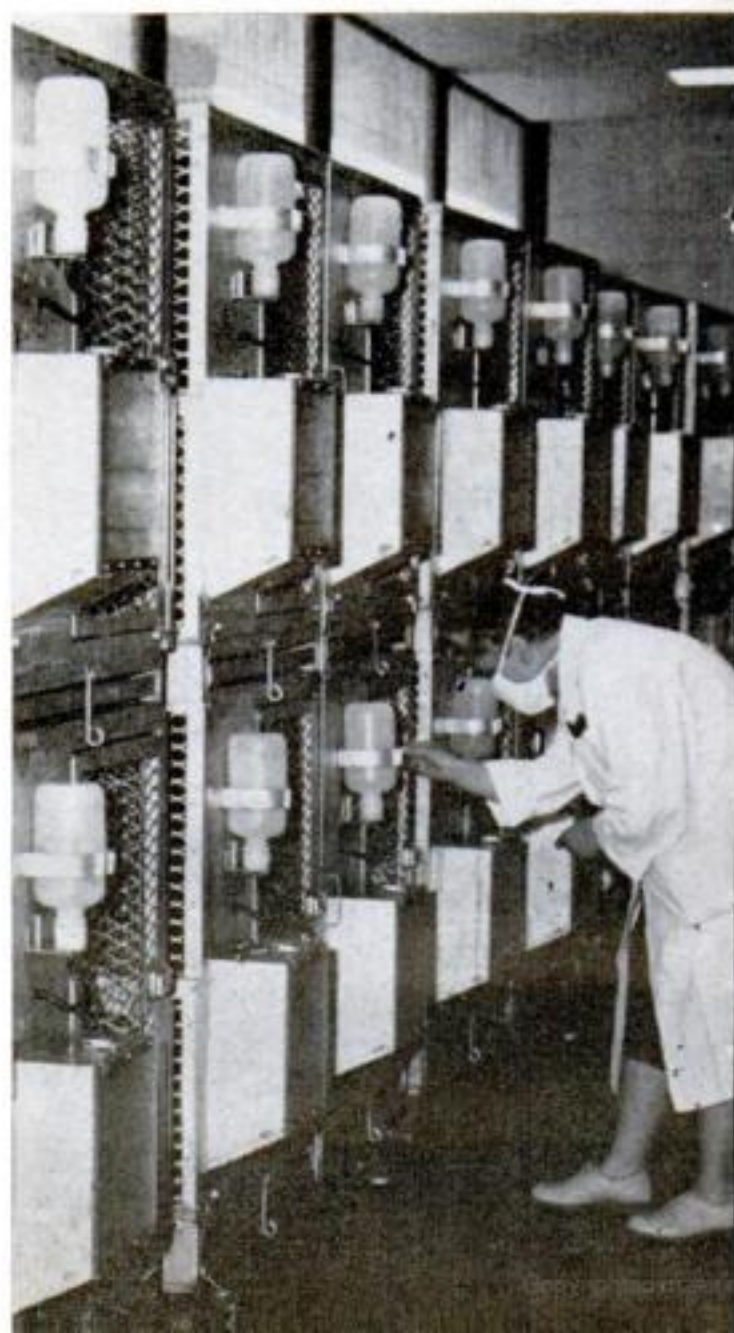
Large groups of adolescent monkeys (one to three years) romp in screened, curved pens.





Raised to become man's partners in medical research, these rhesus monkeys, born at the Center, start life healthy and happy—more cared for and coddled through infancy than many human babies

A typical dormitory room at the Center houses 100 monkeys, with pickproof locks and constant fresh water for their cages. There is room inside for exercise. Partitions can be removed between cages for multiple occupancy.



Dr. Donald E. Pickering (left), director of the new Oregon Primate Research Center, and Tim Kae are shown examining a 2½-month-old rhesus monkey.



With a nipped feeding bottle and a sandbag mother, this baby is a lot happier than he looks.

jungle often need 90 days of special conditioning to catch up with them.

At the Center, diet kitchens, nurseries, and top-notch hospital facilities keep the monkeys in shape for scientific study.

Life in the jungle was never like this. In their Oregon retreat, the monkeys romp in circular cages, devoid of corners where bullies among them might trap the timid.

Babies get elaborate care. They are allowed only the first 24 hours of life with their mothers, who teach them one vital lesson: how to nurse. For the next 10 days, the infants live in incubators, just like the ones hospitals keep for human babies. After that, each young rhesus is caged with an imitation mother.

She's a creature formed of sandbag, plastic, terry cloth, and a nipped feeding bottle set at just the right angle.

After six months of this, the growing monkey goes to live with two others of his own age. But never in all their lives at the Center will mature rhesus males be permitted to share the same room, even in separate, locked cages. The reason is that they're born lockpickers; adult males on the loose together would mean a fight till one got killed, as happens in the jungle.

The Oregon Primate Research Center, devoted to seeking new treatments for man's diseases, new cures for his ills, and better preventives, expects to house 1,000 monkeys by the end of this year. ■ ■

Do Lie Detectors

While the debate about the lie detector's accuracy continues, where does this leave you if your job—or life

WHAT are the chances that you'll be called a liar, a thief, a fraud, or a traitor by an instrument that can, in the hands of an unskilled or irresponsible examiner, make certain changes in your body seem to testify against you?

Better or—depending on how it's looked at—worse than you probably think.

For today, government, industry, and commerce all employ the lie detector to decide whether you'll get the job you want or stay in the one you already have. Under certain circumstances, you may be requested to undergo an experience once reserved for the criminal suspect only.

Rank, position, or good reputation are no protection against the possibility of impeachment by polygraph (lie detector). This was demonstrated last April during the Washington controversy over the TFX aircraft contract. Pentagon investigators, trying to learn how the contents of an embarrassing document in the case reached a newspaperman, threatened the Secretaries of the Navy and the Air Force, the Deputy Secretary of Defense, and a number of prominent civilian and military officials, with lie-detector tests. President Kennedy intervened, saying, "I think it was a mistake to suggest a polygraph."

As long ago as 1895, Cesare Lombroso, an Italian criminologist, claimed that by taking a suspected man's blood pressure during police interrogation he could establish truth or deception.

The late Dr. C. G. Jung, the distinguished Swiss psychiatrist, thought there was a good deal to Lombroso's theory. Jung stated it as his conviction that the guilty could be detected with a "psychogalvanometer"—an instrument that visually indicates the skin's resistance to a very low electric current.

Early in this century, a Harvard psychology professor, Hugo Munsterberg, reported that a liar's own physiology would trap him in his deceit and attempts at evasion or falsehood. Others saw that there often existed a relationship between a man's deception and

Polygraph laboratory of Backster School of Lie Detection has display cases that can be spotlighted one at a time by examiner. An item known to be connected with a crime is displayed among unrelated items, and subject views them. Polygraph records reactions.

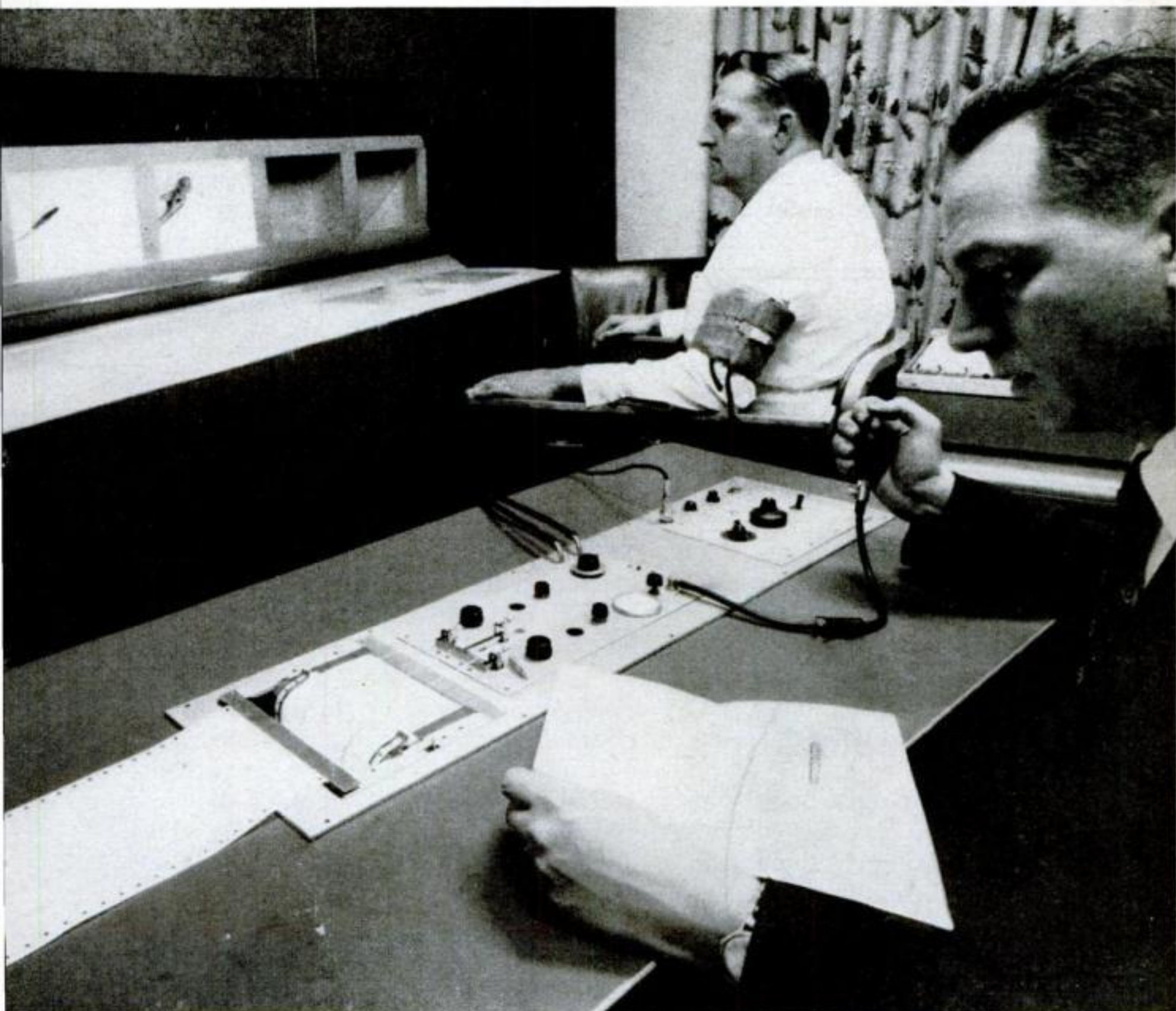
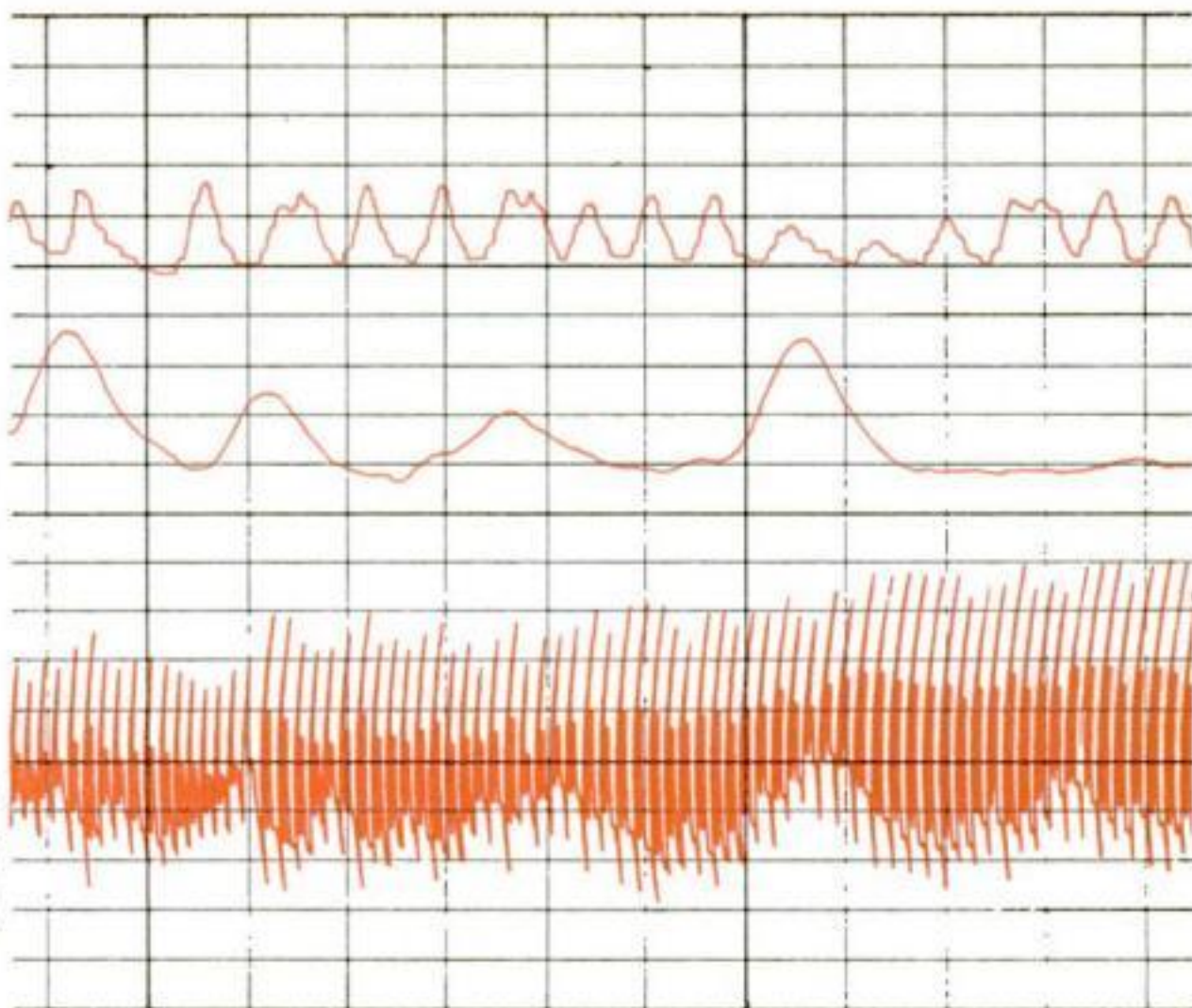


Lie?

—depends upon it?

By Robert Christie

Polygraph chart (of a man who later confessed murder) shows record of breathing (top); changes in skin conductivity (middle); and pulse and blood pressure.



True worth of the polygraph: protection of the innocent

In trained hands the polygraph can sometimes be a suspect's best friend, as was demonstrated recently in Paterson, N.J. On the complaint of a man who had been assaulted and robbed, Robert Foster, a 20-year-old Negro, was arrested and charged with the crime.

A couple of detectives on the case were inclined to believe Foster's protests that he was innocent. At their suggestion, the accused youth submitted to a lie-detector test administered by Joseph F. Campbell Jr., polygraph examiner for the city of Paterson. The test's results supported Foster's insistence that he was not guilty.

But when the case was heard before a magistrate, the robbery victim vigorously insisted that Foster was his assailant. He swore that he recognized Foster's mannerisms and the smell of his shaving lotion. There could be no doubt, he said, that Foster was the man who had attacked him and taken \$200.

Because polygraph findings are not accepted as evidence, without prior stipulation, the magistrate directed that Foster, unable to raise the \$3,500 bail set, be sent to the county jail and held there until such time as his case could be heard by the Passaic County Grand Jury.

his rate of breathing and blood-pressure changes.

The development and use of the polygraph quickly moved ahead after World War I. The 1920s, with their appalling increase in serious crime, provided an ideal laboratory for investigators.

The modern detector. One of the most noted polygraph examiners was Leonarde Keeler who, after majoring in psychology at Stanford University, joined the Berkeley, Calif., police department. There Keeler began to refine an instrument that simultaneously records a suspect's relative changes in blood pressure and respiration during interrogation. Keeler got remarkable results and, from the thugs he dealt with, astonishing confessions.

His hard-bitten customers could take a rubber-hose treatment far more successfully than they could cope with the mysterious and somehow sinister lie detector. It was a new kind of interrogative approach that didn't hurt until, having confessed, they heard what the judge had to say.

Keeler, this country's most noted pioneer in the field, can be credited with today's basic lie-detection equipment. In 1930 he founded his Scientific Crime Detection Laboratory at Chicago's Northwestern University with money donated by that city's businessmen.

Keeler called his apparatus a polygraph—Greek for "many writings."

The lie detector is not a machine, though it is often referred to as one. It is a combination of three instruments: a breathing-rate recorder, connected pneumatically to an attachment fitted around the subject's chest or stomach; a sphygmomanometer, a baglike rubber cuff connected to the "cardio" unit, that responds to variations in blood pressure and rate and strength of pulse; and a pair of metal contacts, attached to the hand or fingers, that evaluate relative changes in skin response.

All three readings are recorded on a roll of graph paper that unreels under three separate pens activated by impulses from the instruments.

The questioning. During a lie-detector test, the examiner asks the subject a number of questions, formulated to fit the case at hand. Some are designed to trigger an emotional reaction if deceptively answered or shied away from.

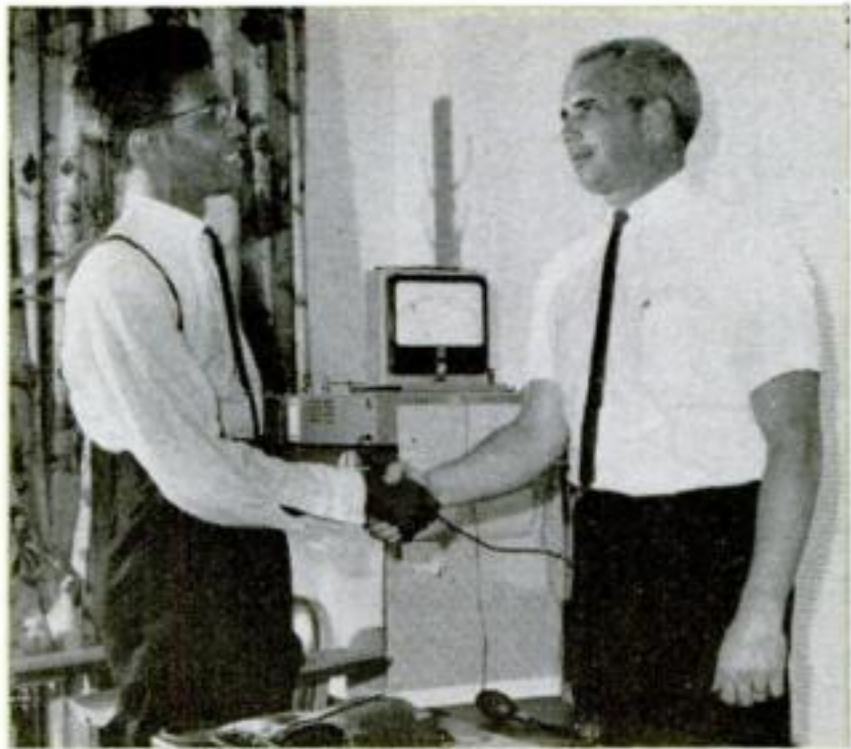
Some questions are neutral, innocuous, so commonplace that they can be answered without the graph showing evidence of emotional turbulence. Deliberately keyed for a nil reaction, they might be such queries as, "Is your last name Brown?" "Is your first name John?" "Were you born in the U. S.?"

The subject answers without any sense

Frustrated by the court's ruling, and confident that the interpretation of the polygraph chart was right, the two detectives went out in search of the real culprit.

They found him, and they found as well that he bore a striking resemblance to the accused. Foster was, of course, released. Polygraph findings, correctly interpreted by a trained examiner, had saved him a stiff prison term. Proponents of lie detection point to cases such as this as indicative of the true worth of the polygraph—vindication of the innocent.

Robert Foster, left, thanks Joseph F. Campbell Jr., Paterson, N.J. examiner.



of stress. They excite no response. The polygraph examiner can read from the graph the lack of such responses on the chart.

But this is only the beginning.

Among the questions selected for lie-detector interrogation, there are several that are crucial, from which a reaction is expected if deception is attempted. Experience shows that even hardened liars find it virtually impossible to control their hidden emotions—though outwardly they may appear unaffected and impassive.

On the reaction to these crucial questions, a determination of deception or truth is made. Additional polygraph questions are now directed at the heart of the crime under investigation. "Did you kill your wife?" "Did you yourself steal most or all of that missing \$5,000?"

All questions, whether neutral or relevant, can ordinarily be answered by a plain *yes* or *no*. An interval is allowed between each question and its reply so that the polygraph can indicate the presence or lack of physiological response.

How valid is it? Here we reach an area where the debate about the lie detector's accuracy and the validity of its findings begins. Experts agree that the technique of questioning a subject, whether for criminal reasons or not, is vitally important. The questions asked

and the manner in which they are asked exceed in importance what the breathing unit, cardio unit, and skin-response unit may be charting.

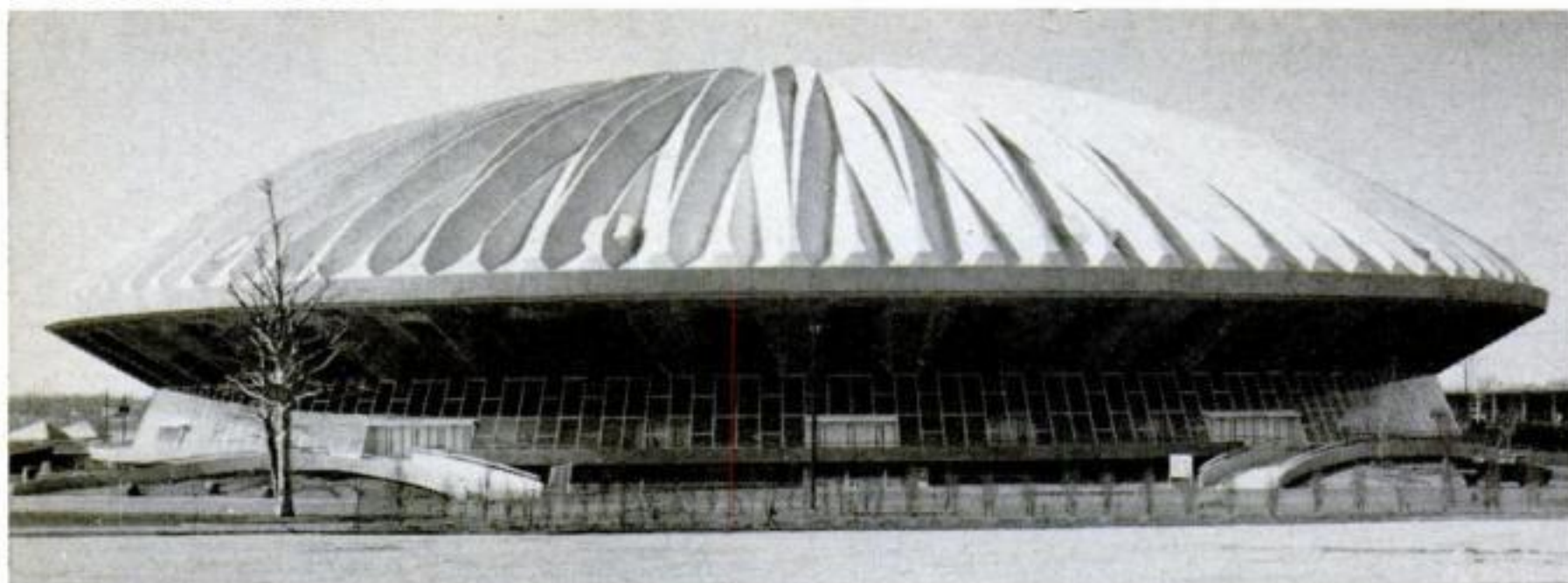
The lie detector is as open to abuse as any other instrument. Because it is associated with the search for deception, real or merely suspected, the subject is at a disadvantage. Moreover, there are polygraph examiners who are not as well-trained, experienced, or ethical as they should be.

In the hands of an untrained or unethical examiner, the lie detector is no better than a blackjack. Abuse, hostility, and expressed suspicion on an incompetent examiner's part can provoke reaction. But these reactions have no true meaning or value since they stem from a source other than the fear of detection.

Some subjects seemingly show no fear-of-detection response. The existence of such individuals was established recently in a murder case in the State of Washington.

Three men were involved, two of them under indictment for murder. The third man was the prosecution's chief witness. When a lie-detector test was run on the two charged with the crime, their reactions were not specific enough to justify an opinion. The response of the prosecution witness was negative throughout.

[Continued on page 202]



Dome of University of Illinois Assembly Hall was poured in folds by new process.



With no inside trusses required, pillarless roof provides a clear view from all of the stadium's 16,000 seats.

Pleated concrete dome covers campus building

Its Assembly Hall, occupying an area 400 feet in diameter, was opened this summer by the University of Illinois at Urbana. The hall, shaped like two giant saucers with the upper one inverted, has seats for 16,000 with unobstructed view and space for 2,000 more around a central stage. It can be used as an auditorium, sports arena, theater, or exhibition hall.

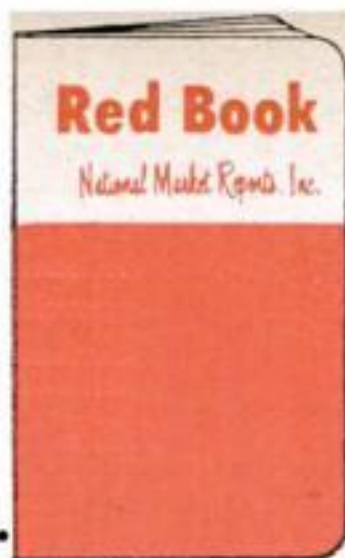
Construction of the pillarless roof involved new principles [PS, Nov. '62]. Interior trusses were eliminated by strengthening the walls.



Sports cars for policewomen

London's policewomen now patrol in 110-m.p.h. MG-A sports cars. They have passed an advanced driving course at the all-male

Metropolitan Police Staff College. Working in pairs on eight-hour shifts, they cover everything from traffic offenses to chasing crooks. They expect surprise, maybe, but no trouble from men drivers they may tag.



Latest average retail values of Buick, Cadillac, Chrysler, De Soto, Edsel, Ford, Thunderbird, Imperial, Lincoln, Plymouth, Pontiac, and Valiant, 1963-1958, compiled exclusively for Popular Science by Red Book, published by National Market Reports, Inc. (For other makes, see August Popular Science.)

What's Your Car Worth?

EVER get the urge to buy a used Cadillac? Or a second-hand Falcon? But you never get around to finding what they're selling for? Sure, pounding the used-car lots takes time. And getting prices that way isn't an exact science.

Your best bet would be to have a copy of *Red Book Official Used Car Valuations*. But it isn't readily available to the average car owner. Now—in a magazine exclusive

—POPULAR SCIENCE publishes current retail values of U.S. used cars, 1963-1958. Compiled by *Red Book*, published by National Market Reports, Inc., these are retail averages. Study the following pages and nail down with a pencil point what a good used car will cost—or what your present car is worth if you're thinking of buying a '63 in the clean-up period before the '64s are introduced.

AVERAGE RETAIL VALUES

The Average Retail Value of a car represents its retail value including radio and heater. AUTOMATIC TRANSMISSION VALUES ARE INCLUDED ON ALL EIGHT CYLINDER MODELS ONLY AND MUST BE ADDED FOR ALL SIXES. The values as shown represent the value of an average car.

OPTIONAL EQUIPMENT

Optional equipment values appear at the end of each model year listing.

Model	Body Type	Avg Retail
BUICK		
Auto. Trans. Included (Exc. 6 Cyl.)		
1963-6		
4000 SPECIAL STANDARD		
4019	Sed 4dr-6.....	2325
4027	Cpe 2dr-6.....	2275
4067	Cpe Conv 2dr-6.....	2525
4045	Wag 4dr-8.....	2650
4035	Wag 4dr-6.....	2600
4100 SPECIAL DeLUXE		
4119	Sed 4dr-6.....	2425
4135	Wag 4dr-6.....	2725
1963-8		
4100 SPECIAL DeLUXE		
4119	Sed 4dr-6.....	2500
4135	Wag 4dr-6.....	2800
4300 SPECIAL SKYLARK		
4347	Cpe H.T. 2dr-6.....	2825
4367	Conv 2dr-5.....	2950

Model	Body Type	Avg Retail
1963-8		
4400 LeSABRE		
4469	Sed 4dr-6.....	2925
4439	Sed H.T. 4dr-6.....	3075
4411	Sed 2dr-6.....	2850
4447	Cpe Spt H.T. 2dr-6.....	3000
4467	Conv 2dr-5.....	3200
4445	Wag 4dr-8.....	3400
4435	Wag 4dr-6.....	3325
4600 INVICTA		
4635	Wag 4dr-6.....	3525
4600 WILDCAT		
4639	Sed H.T. 4dr-6.....	3450
4647	Cpe Spt H.T. 2dr-6.....	3425
4667	Conv 2dr-6.....	3500
4800 ELECTRA 225		
4819	Sed 4dr-6.....	3450
4829	Sed H.T. 4dr-6-6W....	3600
4839	Sed H.T. 4dr-6-4W....	3550
4847	Cpe Spt H.T. 2dr-6.....	3475
4867	Conv 2dr-5.....	3675
4700 RIVIERA		
4747	Cpe Spt H.T. 2dr-6....	3950

Model	Body Type	Avg Retail
"Optional Equipment" for 1963 Buick:		
ADD-Power Brakes*.....		40
ADD-power Strg:		
Special.....		65
Buick Series*.....		95
DEDUCT-Std. Trans.....		180
Special & 4400 Series Only		
*Std. on 4600; 4700 & 4800		
1962-6		
4000 SPECIAL STANDARD		
4019	Sed 4dr-6.....	1900
4027	Cpe 2dr-6.....	1875
4067	Cpe Conv 2dr-6.....	2075
4045	Wag 4dr-8.....	2150
4035	Wag 4dr-6.....	2100
1962-8		
4100 SPECIAL DeLUXE		
4119	Sed 4dr-6.....	2100
4167	Cpe Conv 2dr-6.....	2300
4135	Wag 4dr-6.....	2325
4300 SPECIAL SKYLARK		
4347	Cpe H.T. 2dr-6.....	2350
4367	Conv 2 dr-5.....	2450
4400 LeSABRE		
4469	Sed 4dr-6.....	2350
4439	H.T. 4dr-6.....	2475
4411	Sed 2dr-6.....	2300
4447	H.T. 2dr-6.....	2425
4600 INVICTA		
4639	H.T. 4dr-6.....	2600
4647	H.T. 2dr-6.....	2650
4647	Cpe 2dr-5.....	2825
4667	Cpe Conv 2dr-6.....	2725
4645	Wag 4dr-8.....	2825
4635	Wag 4dr-6.....	2775

Model	Body Type	Avg Retail
4800 ELECTRA		
4819	Sed 4dr-6.....	2875
4829	Riv 4dr-6.....	3075
4839	H.T. 4dr-6.....	3025
4847	H.T. 2dr-6.....	2975
4867	Cpe Conv 2dr-6.....	3100
"Optional equipment" for 1962:		
ADD-Power Brakes.....		30
ADD-Power Strg.....		50
Spec. Series only		
ADD-Power Strg.....		65
DEDUCT-Std. Trans.....		125
Spec. Series only.		
1961-8		
4000 SPECIAL		
4019	Sed 4dr-6.....	1575
4027	Cpe 2dr-6.....	1550
4045	Wag 4dr-8.....	1775
4035	Wag 4dr-6.....	1750
4100 SPECIAL DeLUXE		
4119	Sed 4dr-6.....	1650
4117	SkyL 2dr-6.....	1800
4135	Wag 4dr-6.....	1825
4400 LeSABRE		
4469	Sed 4dr-6.....	1800
4439	H.T. 4dr-6.....	1925
4411	Sed 2dr-6.....	1750
4437	H.T. 2dr-6.....	1925
4467	Conv 2dr-6.....	2000
4445	Wag 4dr-8.....	2100
4435	Wag 4dr-6.....	2050
4600 INVICTA		
4639	H.T. 4dr-6.....	2050
4637	H.T. 2dr-6.....	2050
4667	Conv 2dr-6.....	2125
4700 ELECTRA		
4719	Sed 4dr-6.....	2100
4739	H.T. 4dr-6.....	2225
4737	H.T. 2dr-6.....	2225

CONTINUED

Model	Body Type	Avg Retail
TOWN & COUNTRY WAGONS		
45A	Sta Wag 2 seat-6	1275
45B	Sta Wag 3 seat-9	1300
SARATOGA MC2-M		
41	Sed 4dr-6	1150
43	Sed H.T. 4dr-6	1250
23	Sed H.T. 2dr-6	1250
NEW YORKER MC3-H		
41	Sed 4dr-6	1300
43	Sed H.T. 4dr-6	1400
23	Sed H.T. 2dr-6	1400
27	Cpe Conv 2dr-6	1425
TOWN & COUNTRY WAGONS		
45A	Sta Wag 2 seat-6	1500
45B	Sta Wag 3 seat-9	1525
"300-E"-MC3-H		
23	Cpe H.T. 2dr-6	1600
27	Cpe Conv 2dr-6	1650
"Optional equipment" for 1959 Chrysler:		
ADD-Power Brakes		15
(Windsor only)		
ADD-Power Strg.		45
(Windsor only)		
DEDUCT-For Std. Trans.		75
Windsor only.		
1958-8 WINDSOR		
LC1-L	Sed 4dr-6	650
LC1-L	Sed H.T. 4dr-6	725
LC1-L	Sed H.T. 2dr-6	725
LC1-L	Twn & Ctry-6	775
LC1-L	Twn & Ctry-9	800
SARATOGA		
LC2-M	Sed 4dr-6	725
LC2-M	Sed H.T. 4dr-6	800
LC2-M	Sed H.T. 2dr-6	800
NEW YORKER		
LC3-H	Sed 4dr-6	925
LC3-H	Sed H.T. 4dr-6	1000
LC3-H	Sed H.T. 2dr-6	1000
LC3-H	Cpe Conv-6	1025
LC3-H	Twn & Ctry-6	1050
LC3-H	Twn & Ctry-9	1075
"300D"		
LC3-S	Spt Cpe H.T.-6	1125
LC3-S	Cpe Conv-6	1150
Optional equipment for 1958 Chrysler:		
ADD-Power Brakes		15
Std. on 300D		
ADD-Power Strg.		30
Windsor Only		
DEDUCT-Std. Trans.		50
Windsor only.		
DE SOTO		
Auto. Trans. Included (Exc. 6 Cyl.)		
1961-8 DeSOTO RS1-L		
43	H.T. 4dr-6	1575
23	H.T. 2dr-6	1575
"Optional equipment" for 1961:		
ADD-Power Brakes		20
ADD-Power Strg.		65
DEDUCT-Std. Trans.		115
1960-8 FIREFLITE PS1-L		
41	Sed 4dr-6	1080
43	Sed H.T. 4dr-6	1185
23	Sed H.T. 2dr-6	1185
ADVENTURER PS3-M		
41	Sed 4dr-6	1215
43	Sed H.T. 4dr-6	1320
23	Sed H.T. 2dr-6	1320
"Optional equipment" for 1960 De Soto:		
ADD-Power Brakes		15
ADD-Power Strg.		50
ADD-Torque Flite over		
Powerflite-Fireflite only-		15
Std. on Adv.		
DEDUCT-Std. Trans.		95
Fireflite only		
1959-8 FIRESWEEP MS1-L		
41	Sed 4dr-6	675
43	Sportsman 4dr-6	780
23	Sportsman 2dr-6	780
27	Cpe Conv. 2dr-6	810
STATION WAGONS		
45A	Shopper 2 seat-6	915
45B	Expl. 3 seat-9	960

Model	Body Type	Avg Retail
FIREDOVE MS2-M		
41	Sed 4dr-6	750
43	Sportsman 4dr-6	850
23	Sportsman 2dr-6	850
27	Cpe Conv. 2dr-6	885
FIREFLITE MS3-H		
41	Sed 4dr-6	915
43	Sportsman 4dr-6	1020
23	Sportsman 2dr-6	1020
27	Cpe Conv. 2dr-6	1050
STATION WAGONS		
45A	Shopper 2 seat-6	1050
45B	Exp. 3 seat-9	1080
ADVENTURER MS3-H		
23	Cpe H.T. 2dr-6	1125
27	Cpe Conv. 2dr-6	1150
"Optional equipment" for 1959 DeSoto:		
ADD-Power Brakes		15
Std. on Adv.		
ADD-Power Strg.		45
Std. on Adv.		
DEDUCT-Std. Trans.		75
Firesweep & Fireflite		
1958-8 FIRESWEEP		
LS1-L	Sed 4dr-6	480
LS1-L	Sportsman 4dr-6	540
LS1-L	Sportsman 2dr-6	540
LS1-L	Cpe Conv-6	570
LS1-L	Sta Wag 4dr-6	615
LS1-L	Sta Wag 4dr-9	645
FIREDOVE		
LS2-M	Sed 4dr-6	550
LS2-M	Sportsman 4dr-6	615
LS2-M	Sportsman 2dr-6	615
LS2-M	Cpe Conv-6	645
FIREFLITE		
LS3-H	Sed 4dr-6	630
LS3-H	Sportsman 4dr-6	700
LS3-H	Sportsman 2dr-6	700
LS3-H	Cpe Conv-6	750
LS3-H	Sta Wag 4dr-6	780
LS3-H	Sta Wag 4dr-9	825
ADVENTURER		
LS3-S	Sportsman 2dr-6	825
LS3-S	Cpe Conv-6	825
"Optional equipment" for 1958 DeSoto:		
ADD-Power Brakes		15
ADD-Power Strg.		30
Std. on Adventurer		
DEDUCT-Std. Trans.		50
Firesweep & Fireflite		
EDSEL		
Auto. Trans. Included (Exc. 6 Cyl.)		
1960-8 RANGER		
58A	Sed 4dr-6	840
57A	Sed H.T. 4dr-6	915
64A	Sed 2dr-6	810
63A	Sed H.T. 2dr-6	915
76B	Cpe Conv 2dr-6	930
STATION WAGONS		
71E	Villager 4dr-9	1020
71F	Villager 4dr-6	990
"Optional equipment" for 1960 Edsel:		
ADD-Power Brakes		20
ADD-Power Strg.		30
ADD-352" Eng.		15
ADD-Dual Power Trans.		15
Over Mile-O-Matic		
DEDUCT-Std. Trans.		75
DEDUCT-6 Cyl. Eng.		40
From above 8 Cyl.		
1959-8 RANGER		
58D	Sed 4dr-6	480
57F	Sed H.T. 4dr-6	550
64C	Sed 2dr-6	450
63F	Sed H.T. 2dr-6	550
CORSAIR		
58B	Sed 4dr-6	550
57B	Sed H.T. 4dr-6	630
63B	Sed H.T. 2dr-6	630
76E	Cpe Conv 2dr-6	660
STATION WAGONS		
71F	Villager 4dr-6	600
71E	Villager 4dr-9	630
"Optional equipment" for 1959 Edsel:		
ADD-Power Brakes		15
ADD-Power Strg.		25

Model	Body Type	Avg Retail
ADD-Mile-O-Matic 6 Cyl. only		
DEDUCT-For 6 cyl.		30
DEDUCT-Std. Trans.		65
8 Cyl. only		
1958-8 RANGER		
58A	Sed 4dr-6	250
57A	Sed H.T. 4dr-6	330
64A	Sed 2dr-6	225
63A	Sed H.T. 2dr-6	330
PACER		
58B	Sed 4dr-6	300
57B	Sed H.T. 4dr-6	360
63B	Sed H.T. 2dr-6	360
76B	Convertible-6	390
STATION WAGONS		
79C	Villager 4dr-6	300
79D	Bermuda 4dr-6	345
79A	Villager 4dr-9	330
79B	Bermuda 4dr-9	375
59A	Roundup 2dr-6	250
CORSAIR		
57A	Sed H.T. 4dr-6	330
63A	Sed H.T. 2dr-6	330
CITATION		
57B	Sed H.T. 4dr-6	360
63B	Sed H.T. 2dr-6	360
76B	Conv.-6	390
"Optional equipment" for 1958 Edsel:		
ADD-Power Brakes		15
ADD-Power Strg.		20
ADD-Overdrive		15
DEDUCT-Std. Trans.		50
Ranger & Pacer only		
FORD and THUNDERBIRD*		
Auto. Trans. Included (Exc. 6 Cyl.)		
1963-6 Falcon STANDARD SERIES		
54B	Sed 4dr-6	1900
62A	Sed 2dr-6	1850
FUTURA SERIES		
54B	Sed 4dr-6	2000
62B	Sed 2dr-6	1950
63B	H.T. 2dr-6	2025
76A	Conv 2dr-6	2250
76B	Conv Spt. 2dr-5	2275
STATION WAGONS		
71C	Squire 4dr-6	2375
71B	Deluxe 4dr-6	2225
59B	Deluxe 2dr-6	2175
71A	Standard 4dr-6	2150
59A	Standard 2dr-6	2100
1963-6 FAIRLANE		
54A	Sed 4dr-6	2025
62A	Sed 2dr-6	1975
71D	Ranch Wag 4dr-6	2275
FAIRLANE 500		
54B	Sed 4dr-6	2100
62B	Sed 2dr-6	2050
65A	H.T. 2dr-6	2125
65B	Cpe Spt. 2dr-5	2250
71E	Squire Wag 4dr-6	2475
71B	Ranch Wag Cus 4dr-6	2350
1963-6 FORD 300		
54E	Sed 4dr-6	2125
62E	Sed 2dr-6	2075
GALAXIE		
54B	Sed 4dr-6	2225
62B	Sed 2dr-6	2175
GALAXIE 500		
54A	Sed 4dr-6	2350
75A	H.T. 4dr-6	2475
62A	Sed 2dr-6	2300
65A	H.T. 2dr-6	2425
76A	Conv 2dr-6	2675
STATION WAGONS		
71A	Squire 4dr-9	2750
71E	Squire 4dr-6	2700
71C	Ctry Sed 4dr-9	2625
71B	Ctry Sed 4dr-6	2550
1963-8 FAIRLANE		
54A	Sed 4dr-6	2225
62A	Sed 4dr-6	2175
71D	Ranch Wag 4dr-6	2475

Model	Body Type	Avg Retail
FAIRLANE 500		
54B	Sed 4dr-6	2300
62B	Sed 2dr-6	2250
65A	H.T. 2dr-6	2325
65B	Cpe Spt 2dr-5	2450
71E	Squire Wag 4dr-6	2675
71B	Ranch Cus 4dr-6	2550
1963-8		
FORD 300		
54E	Sed 4dr-6	2350
62E	Sed 2dr-6	2300
GALAXIE		
54B	Sed 4dr-6	2450
62B	Sed 2dr-6	2400
GALAXIE 500		
54A	Sed 4dr-6	2575
75A	H.T. 4dr-6	2700
62A	Sed 2dr-6	2525
65A	H.T. 2dr-6	2650
76A	Conv 2dr-6	2900
GALAXIE 500 /XL		
75C	H.T. 4dr-5	2975
63C	H.T. 2dr-5	2925
65B	Fast Back H.T.	2925
76B	Conv 2dr-5	3125
STATION WAGONS		
71A	Squire 4dr-9	2975
71E	Squire 4dr-6	2925
71C	Ctry Sed 4dr-9	2850
71B	Ctry Sed 4dr-6	2775
1963-8 THUNDERBIRD		
63A	H.T. 2dr-4	3900
63B	Landau H.T. 2dr-4	3975
76A	Conv 2dr-4	4250
"Optional equipment" on 1963 Ford Series:		
ADD-Power Brakes*		30
Std. on T-Bird		
ADD-Power Strg*		65
Std. on T-Bird		
ADD-Optional Engines:		
170" 101 HP.		25
352" 2V-220 HP.		40
390" 4V-300 HP.		120
406" 4V-385 HP.		315
406" 6V-405 HP.		370
390" 6V T-Bird.		225
ADD-4 Speed Trans-Falcon		75
ADD-4 Speed Trans-Ford.		175
ADD-Overdrive.		95
ADD-Ford-O-Matic:		
Falcon.		150
Ford 6 cyl.		170
DEDUCT-Std. Trans.-8 cyl.		180
ADD-Cruise-O-Matic.		200
Std. on T-Bird		
1962-6		
FALCON		
STANDARD SERIES		
12	Sed 4dr-6	1500
11	Sed 2dr-6	1475
22	Wag 4dr-6	1675
21	Wag 2dr-6	1625
DeLuxe SERIES		
12	Sed 4dr-6	1550
11	Sed 2dr-6	1525
17	Futura 2dr-5	1675
26	Squire 4dr-6	1900
22	Wag 4dr-6	1700
21	Wag 2dr-6	1675
STATION BUS SERIES		
Station Bus.		1700
Club Wagon.		1800
DeL. Wagon.		1950
1962-6-FORD		
FAIRLANE		
32	Sed 4dr-6	1575
31	Sed 2dr-6	1525
FAIRLANE '500'		
42	Sed 4dr-6	1625
41	Sed 2dr-6	1575
	Sed Spt.-5	1750
GALAXIE '100'		
52	Sed 4dr-6	1725
51	Sed 2dr-6	1700
GALAXIE '500'		
62	Sed 4dr-6	1875
64	H.T. 4dr-6	2000
61	Sed 2dr-6	1850
63	H.T. 2dr-6	2000
65	Cpe Conv 2dr-5	2075

Model	Body Type	Avg Retail	Model	Body Type	Avg Retail	Model	Body Type	Avg Retail	Model	Body Type	Avg Retail	
STATION WAGONS			FAIRLANE 500			STATION WAGONS			ADD-430" Eng. (T-Bird)...			
71	Ranch 4dr-6	1875	42	Sed Twn 4dr-6	1375	62	Ran Wag 4dr-6	1125	ADD-Ford-O-Matic.....			
74	Country 4dr-6	2000	41	Sed Clb 2dr-6	1350	61	Ran Wag 2dr-6	1100	6 Cyl. only			
72	Country 4dr-6	1950	GALAXIE			66	Sed Ctry 4dr-9	1200	ADD-Cruise-O-Matic.....			
78	Squire 4dr-9	2100	52	Sed Twn 4dr-6	1550	64	Sed Ctry 4dr-6	1175	DEDUCT-Std. Trans.....			
76	Squire 4dr-6	2050	54	Vic Twn 4dr-6	1675	68	Ctry Sq 4dr-9	1275	8 Cyl. only			
1962-8			51	Sed Clb 2dr-6	1525	1960-8			1958-6			
FAIRLANE			57	Vic Clb 2dr-6	1675	THUNDERBIRD			CUSTOM "300"			
32	Sed 4dr-6	1725	53	Starliner 2dr-6	1675	71	Hardtop 2dr-4	2000	73A	Sed 4dr-6	425	
31	Sed 2dr-6	1675	55	Conv Sunliner-6	1725	73	Conv 2dr-4	2075	70A	Sed 2dr-6	400	
FAIRLANE "500"			STATION WAGONS			ADD-Sliding Roof			70D	Cpe Bus-3	325	
42	Sed 4dr-6	1775	62	Ran Wag 4dr-6	1500	"Optional equipment" for 1960			FAIRLANE			
41	Sed 2dr-6	1725	61	Ran Wag 2dr-6	1450	Ford & T-Bird:			58A	Sed Twn 4dr-6	450	
	Sed Spt-5	1900	66	Sed Ctry 4dr-9	1600	ADD-Power Brakes.....			57B	Victoria 4dr-6	525	
GALAXIE "100"			64	Sed Ctry 4dr-6	1550	ADD-Power Strg.....			64A	Sed Clb 2dr-6	425	
52	Sed 4dr-6	1875	68	Ctry Sq 4dr-9	1650	ADD-Overdrive.....			63B	Victoria 2dr-6	525	
51	Sed 2dr-6	1850	67	Ctry Sq 4dr-6	1600	ADD-352" 4-V Eng.....			FAIRLANE "500"			
GALAXIE "500"			1961-8-THUNDERBIRD			ADD-430" 4-V Eng.....			58B	Sed Twn 4dr-6	525	
62	Sed 4dr-6	2025	71	Hardtop 2dr-4	2725	T-Bird only			57A	Victoria 4dr-6	600	
64	H.T. 4dr-6	2150	73	Conv 2dr-4	2825	ADD-Ford-O-Matic.....			64B	Sed Clb 2dr-6	500	
61	Sed 2dr-6	2000	"Optional equipment" for 1961:			6 Cyl. only			63A	Victoria 2dr-6	600	
63	H.T. 2dr-6	2150	ADD-Power Brakes*.....			ADD-Cruise-O-Matic.....			76B	Sunliner Conv-6	650	
65	Cpe Conv 2dr-5	2225	ADD-Power Strg.*.....			DEDUCT-Std. Trans.....			STATION WAGONS			
GALAXIE "500" XL			ADD-Overdrive.....			8 Cyl. only			79D	Sed Ctry 4dr-6	575	
	H.T. 2dr-5	2325	N.A. on T-Bird			DEDUCT-Std. Trans.....			79C	Sed Ctry 4dr-9	600	
	Cpe Conv 2dr-5	2425	ADD-Optional Engines:			T-Bird only			79E	Ctry Sqr 4dr-9	625	
STATION WAGONS			101 HP 6 Cyl. Falcon....			ADD-DeL. Trim.....			79A	Ran Wag 4dr-6	475	
71	Ranch 4dr-6	2025	220 HP 8 Cyl.....			Falcon only			59A	Ran Wag 2dr-6	450	
74	Country 4dr-9	2150	300 HP 8 Cyl.....			1959-6			59B	Del Rio 2dr-6	475	
72	Country 4dr-6	2100	ADD-Ford-O-Matic:			CUSTOM 300			1958-8			
78	Squire 4dr-9	2250	Falcon 6 cyl.....			58E Sed 4dr-6.....			CUSTOM "300"			
76	Squire 4dr-6	2200	Ford 6 cyl.....			58F Sed 2dr-6.....			73A	Sed 4dr-6	525	
1962-8			DEDUCT-Std. Trans. 8's...			64G Cpe Bus-3.....			70A	Sed 2dr-6	500	
THUNDERBIRD			ADD-Cruise-O-Matic.....			FAIRLANE			70D	Cpe Bus-3	425	
83	H.T. 2dr-4	3125	Std. on T-Bird			58A Sed Twn. 4dr-6.....			FAIRLANE			
83	Landau 2dr-4	3175	ADD-Swing. Strg. Wh....			64A Sed Clb 2dr-6.....			58A	Sed Twn 4dr-6	550	
85	Cpe Conv 2dr-4	3400	T-Bird only			58B Sed Twn. 4dr-6.....			57B	Victoria 4dr-6	625	
85	Tonneau 2dr-4	3825	ADD-DeL. Trim.....			57A Vic Twn. 4dr-6.....			64A	Sed Clb 2dr-6	525	
"Optional equipment" for 1962:			Falcon only			64B Sed Clb. 2dr-6.....			63B	Victoria 2dr-6	625	
ADD-Power Brakes*.....			*N.A. on Falcon-Std. on T-Bird			63A Vic Clb. 2dr-6.....			FAIRLANE "500"			
ADD-Power Strg.*.....			1960-6			GALAXIE			58B Sed Twn 4dr-6.....	625		
Std. on T-Bird			FALCON			54A Sed Twn. 4dr-6.....			57A Victoria 4dr-6.....	700		
ADD-Engine Options:			58A Sed 4dr-6.....			75A Vic. Twn. 4dr-6.....			64B Sed Clb 2dr-6.....	600		
170" 101 HP		20	54A Sed 2dr-6.....			64H Sed Clb 2dr-6.....			63A Victoria 2dr-6.....	700		
352" 2V-220 HP		25	71A Sta. Wag. 4dr-6.....			65A Vic. Clb. 2dr-6.....			76B Sunliner Conv-6.....	750		
390" 4V-300 HP		80	59A Sta. Wag. 2dr-6.....			76B Conv Sunliner-6.....			51A Sky. Re'ble.....	750		
390" 4V-375 HP		190	1960-6			STATION WAGONS			STATION WAGONS			
390" 6V-401 HP		250	CUSTOM 300 (Fleet)			71H Ran Wag 4dr-6.....			79D Sed Ctry 4dr-6.....	675		
390" 6V-T-Bird		125	22 Sed 4dr-5.....			71F Sed Ctry 4dr-6.....			79C Sed Ctry 4dr-9.....	700		
ADD-4 Speed Trans.....		120	21 Sed 2dr-5.....			71E Sed Ctry 4dr-9.....			79E Ctry Sqr 4dr-9.....	725		
ADD-Overdrive.....		65	FAIRLANE			71G Ctry Sq. 4dr-9.....			79A Ran Wag 4dr-6.....	575		
ADD-Automatic Trans.			32 Sed 4dr-6.....			59C Ran Wag 2dr-6.....			59A Ran Wag 2dr-6.....	550		
Ford-O-Matic Falcon....		95	31 Sed 2dr-6.....			59D Del Rio 2dr-6.....			59B Del Rio 2dr-6.....	575		
Ford-O-Matic 6 cyl.....		120	33 Cpe Bus-3.....			1959-8			THUNDERBIRD			
DEDUCT-Std. Trans.....		125	FAIRLANE 500			CUSTOM 300			63A Tudor-4.....	1350		
8 cyl.			42 Sed Twn 4dr-6.....			58E Sed 4dr-6.....			76A Conv.....	1425		
ADD-Cruise-O-Matic			41 Sed Clb 2dr-6.....			64F Sed 2dr-6.....			"Optional equipment" for 1958 Ford:			
Std. T-Bird		150	GALAXIE			64G Cpe Bus-3.....			ADD-Power Brakes.....			
*Galaxie Series only			52 Sed Twn 4dr-6.....			FAIRLANE			ADD-Power Strg.....			
1961-6-FALCON			54 Vic Twn 4dr-6.....			58A Sed Twn 4dr-6.....			ADD-Overdrive.....			
12	Sed 4dr-6	1175	51 Sed Clb 2dr-6.....			64A Sed Clb 2dr-6.....			ADD-Ford-O-Matic (6 cyl.)			
11	Sed 2dr-6	1150	SPECIAL			58B Sed Twn 4dr-6.....			ADD-Cruise-O-Matic.....			
17	Futura 2dr	1275	53 Starliner 2dr-6.....			57A Vic Twn 4dr-6.....			(Over Ford-O-Matic)			
22	Sta Wag 4dr-6	1325	55 Conv Sunliner-6.....			64B Sed Clb 2dr-6.....			DEDUCT-Std. Trans.....			
21	Sta Wag 2dr-6	1300	STATION WAGONS			63A Vic Clb 2dr-6.....			(8 cyl. only)			
1961-6			62 Ran Wag 4dr-6.....			GALAXIE			IMPERIAL*			
FAIRLANE			61 Ran Wag 2dr-6.....			54A Sed Twn 4dr-6.....			Auto. Trans. Included (Exc. 6 Cyl.)			
32	Sed Twn 4dr-6	1175	66 Sed Ctry 4dr-9.....			75A Vic. Twn 4dr-6.....			1963-8			
31	Sed Clb 2dr-6	1150	64 Sed Ctry 4dr-6.....			64H Sed Clb 2dr-6.....			IMPERIAL CUSTOM TY1-L			
FAIRLANE 500			68 Ctry Sq 4dr-9.....			65A Vic Clb 2dr-6.....			914 H.T. 4dr-6.....			
42	Sed Twn 4dr-6	1250	1960-8			51A Sky. H.T. Re'Tble.....			4525			
41	Sed Clb 2dr-6	1225	CUSTOM 300 (Fleet)			76B Conv Sunliner-6.....			912 H.T. 2dr-6.....			
GALAXIE			22 Sed 4dr-5.....			STATION WAGONS			4425			
52	Sed Twn 4dr-6	1400	21 Sed 2dr-5.....			71H Ran. Wag. 4dr-6.....			IMPERIAL CROWN TY1-M			
54	Vic Twn 4dr-6	1525	FAIRLANE			71F Sed Ctry 4dr-6.....			924 H.T. 4dr-6.....			
51	Sed Clb 2dr-6	1375	32 Sed 4dr-6.....			71E Sed Ctry 4dr-9.....			4825			
57	Vic Clb 2dr-6	1525	31 Sed 2dr-6.....			71G Ctry Sq. 4dr-9.....			922 H.T. 2dr-6.....			
53	Starliner 2dr-6	1525	33 Cpe Bus-3.....			59C Ran. Wag. 2dr-6.....			4725			
55	Conv Sunliner-6	1575	FAIRLANE 500			59D Del Rio 2dr-6.....			925 Conv 2dr-6.....			
STATION WAGONS			42 Sed Twn 4dr-6.....			THUNDERBIRD			4925			
62	Ran Wag 4dr-6	1375	41 Sed Clb 2dr-6.....			63A Hardtop 2dr-4.....			IMPERIAL LE BARON TY1-H			
61	Ran Wag 2dr-6	1325	GALAXIE			76A Conv 2dr-4.....			934 H.T. 4dr-6.....			
66	Sed Ctry 4dr-9	1475	52 Sed Twn 4dr-6.....			"Optional equipment" for 1959 Ford:			5425			
64	Sed Ctry 4dr-6	1425	54 Vic Twn 4dr-6.....			ADD-Power Brakes.....			1962-8			
68	Ctry Sq 4dr-9	1525	51 Sed Clb 2dr-6.....			ADD-Power Strg.....			IMPERIAL CUSTOM SY1-L			
67	Ctry Sq 4dr-6	1475	SPECIAL			ADD-Overdrive.....			914 H.T. 4dr-6.....			
1961-8			53 Starliner 2dr-6.....			25			3450			
FAIRLANE			55 Conv Sunliner-6.....			25			912 H.T. 2dr-6.....			
32	Sed Twn 4dr-6	1300				25			3375			
31	Sed Clb 2dr-6	1275							924 H.T. 4dr-6.....			
									3750			
									922 H.T. 2dr-6.....			
									3675			
									925 Cpe Conv 2dr-6.....			
									3800			
									IMPERIAL LeBARON SY1-H			
									934 H.T. 4dr-6.....			
									3950			

Model	Body Type	Avg Retail
"Standard equipment" for 1962: Power Brakes, Power Strg., Torque Flite Trans.		
1961-8		
IMPERIAL CUSTOM RYI-L		
43	Southamp 4dr-6.....	2525
23	Southamp 2dr-6.....	2475
IMPERIAL CUSTOM RYI-M		
43	Southamp 4dr-6.....	2800
23	Southamp 2dr-6.....	2750
27	Conv. 2dr-6.....	2900
IMPERIAL LeBARON RYI-H		
43	Southamp 4dr-6.....	3125
"Standard equipment" for 1961: Power Brakes, Power Strg., Torque Flite Tr.		
1960-8		
IMPERIAL CUSTOM PYI-L		
913	Sed 4dr-6.....	1950
914	Southamp 4dr-6.....	2075
912	Southamp 2dr-6.....	2075
IMPERIAL CROWN PYI-M		
923	Sed 4dr-6.....	2125
924	Southamp 4dr-6.....	2250
922	Southamp 2dr-6.....	2250
925	Cpe Conv. 2dr-6.....	2300
IMPERIAL LE BARON PYI-H		
933	Sed 4dr-6.....	2275
934	Southamp 4dr-6.....	2400
"Standard equipment" for 1960 Imperial: Torque Flite Trans. Power Strg., and Power Brakes.		
1959-8		
IMPERIAL CUSTOM MYI-L		
41	Sed 4dr-6.....	1350
43	Southamp 4dr-6.....	1475
23	Southamp 2dr-6.....	1475
IMPERIAL CROWN MYI-M		
41	Sed 4dr-6.....	1475
43	Southamp 4dr-6.....	1600
23	Southamp 2dr-6.....	1600
27	Cpe Conv. 2dr-6.....	1625
IMPERIAL LE BARON MYI-H		
41	Sed 4dr-6.....	1625
43	Southamp 4dr-6.....	1750
Standard equipment for 1959 Imperial: Torque Flite Trans., Pwr. Strg., & Pwr. Brakes		
1958-8		
IMPERIAL		
LYI-L	Sed 4dr-6.....	950
LYI-L	Southamp 4dr-6.....	1050
LYI-L	Southamp 2dr-6.....	1050
IMPERIAL CROWN		
LYI-M	Sed 4dr-6.....	1050
LYI-M	Southamp 4dr-6.....	1150
LYI-M	Southamp 2dr-6.....	1150
LYI-M	Cpe Conv-6.....	1175
IMPERIAL LE BARON		
LYI-H	Sed 4dr-6.....	1125
LYI-H	Southamp 4dr-6.....	1225
Standard equipment for 1958 Imperial: Torque Flite, Pwr. Strg., Pwr. Brakes		
LINCOLN *		
Auto. Trans. Included (Exc. 6 Cyl.)		
1963-8		
LINCOLN CONTINENTAL		
53A	Sed 4dr-6.....	5675
74A	Conv 4dr-6.....	6075
"Standard equipment" same as 1962		
1962-8		
LINCOLN CONTINENTAL		
53A	Sed 4dr-6.....	4375
74A	Cpt Conv 4dr-6.....	4675
"Standard equipment" for 1962: Power Brakes, Power Strg., Automatic Trans.		
1961-8		
LINCOLN CONTINENTAL		
53A	Sed 4dr-6.....	3225
74A	Conv 4dr-6.....	3400

Model	Body Type	Avg Retail
"Standard equipment" for 1961: Power Brakes, Power Strg., Twin- Range Drive.		
1960-8		
LINCOLN		
53A	Sed 4dr-6.....	1725
57A	Sed H.T. 4dr-6.....	1850
63A	Cpe H.T. 2dr-6.....	1850
LINCOLN PREMIERE		
53B	Sed 4dr-6.....	1925
57B	Sed H.T. 4dr-6.....	2050
63B	Cpe H.T. 2dr-6.....	2050
CONTINENTAL MARK V		
54A	Sed 4dr-6.....	2275
75A	Sed H.T. 4dr-6.....	2400
65A	Cpe H.T. 2dr-6.....	2400
68A	Cpe Conv 2dr-6.....	2500
"Standard equipment" for 1960 Lincoln: Twin-range Turbo Trans., Power Strg., and Power Brakes.		
1959-8		
LINCOLN		
53A	Sed 4dr-6.....	1350
57A	Sed H.T. 4dr-6.....	1450
63A	Cpe H.T. 2dr-6.....	1450
LINCOLN PREMIERE		
53B	Sed 4dr-6.....	1450
57B	Sed H.T. 4dr-6.....	1550
63B	Cpe H.T. 2dr-6.....	1550
CONTINENTAL MARK IV		
54A	Sed 4dr-6.....	1650
75A	Sed H.T. 4dr-6.....	1775
65A	Cpe H.T. 2dr-6.....	1775
68A	Cpe Conv 2dr-6.....	1825
"Standard equipment" for 1959 Lincoln: Twin Range Trans., Power Strg., Power Brakes.		
1958-8		
LINCOLN CAPRI		
53A	Sed 4dr-6.....	850
57A	Sed H.T. 4dr-6.....	950
63A	Cpe H.T. 2dr-6.....	950
LINCOLN PREMIER		
53B	Sed 4dr-6.....	975
57B	Sed H.T. 4dr-6.....	1075
63B	Cpe H.T. 2dr-6.....	1075
CONTINENTAL MARK III		
54A	Sed 4dr-6.....	1200
75A	Sed H.T. 4dr-6.....	1300
65A	Cpe H.T. 2dr-6.....	1300
68A	Cpe Conv-6.....	1325
Standard equipment for 1958 Lincoln: Turbo-Drive, Power Brakes, Power Strg.		
PLYMOUTH *		
Auto. Trans. Included (Exc. 6 Cyl.)		
1963-6		
VALIANT V-100 TVI-L		
113	Sed 4dr-6.....	1875
111	Sed 2dr-6.....	1825
156	Wag 4dr-6.....	2100
VALIANT V 200 TVI-H		
133	Sed 4dr-6.....	1975
131	Sed 2dr-6.....	1925
135	Conv 2dr-5.....	2175
176	Wag 4dr-6.....	2200
VALIANT SIGNET 200 TVI-P		
142	H.T. 2dr-5.....	2075
145	Conv 2dr-5.....	2275
PLYMOUTH		
1963-6		
SAVOY TP1-L		
213	Sed 4dr-6.....	2025
211	Sed 2dr-6.....	1975
257	Wag 4dr-9.....	2400
256	Wag 4dr-6.....	2325
BELVEDERE-TP1-M		
223	Sed 4dr-6.....	2150
221	Sed 2dr-6.....	2100
222	H.T. 2dr-6.....	2175
FURY TP1-H		
233	Sed 4dr-6.....	2275
232	H.T. 2dr-6.....	2350

Model	Body Type	Avg Retail
1963-8		
SAVOY TP2-L		
313	Sed 4dr-6.....	2250
311	Sed 2dr-6.....	2200
357	Wag 4dr-9.....	2625
356	Wag 4dr-6.....	2550
BELVEDERE TP2-M		
323	Sed 4dr-6.....	2375
321	Sed 2dr-6.....	2325
322	H.T. 2dr-6.....	2400
367	Wag 4dr-9.....	2725
366	Wag 4dr-6.....	2650
FURY TP2-H		
333	Sed 4dr-6.....	2500
334	H.T. 4dr-6.....	2625
332	H.T. 2dr-6.....	2575
335	Conv 2dr-6.....	2825
377	Wag 4dr-9.....	2900
376	Wag 4dr-6.....	2825
SPORT FURY TP2-P		
342	H.T. 2dr-5.....	2725
345	Conv 2dr-5.....	2900
"Optional equipment" on 1963 Plymouth Series:		
ADD-Power Brakes-		
Plymouth.....	30	
ADD-Power Strg.-Valiant.....	65	
ADD-Power Strg.-Plymouth.....	65	
ADD-361 V-8 Eng.....	45	
ADD-383 V-8 Eng.....	100	
ADD-Torque Flite Trans.: Valiant.....	150	
Plymouth-6 cyl.....	170	
DEDUCT-Std. Trans.-8 cyl.....	180	
1962-6-VALIANT		
VALIANT V-100-SV1-L		
113	Sed 4dr-6.....	1450
111	Sed 2dr-6.....	1400
156	Wag 4dr-6.....	1600
VALIANT V-200 SV1-H		
133	Sed 4dr-6.....	1500
131	Sed 2dr-6.....	1450
176	Wag 4dr-6.....	1650
SIGNET 200-SV1-P		
142	H.T. 2dr-6.....	1625
1962-6-PLYMOUTH		
SAVOY SP1-L		
213	Sed 4dr-6.....	1500
211	Sed 2dr-6.....	1475
256	Wag 4dr-6.....	1725
BELVEDERE SP1-M		
223	Sed 4dr-6.....	1600
221	Sed 2dr-6.....	1575
222	H.T. 2dr-6.....	1700
266	Wag 4dr-6.....	1825
FURY SP1-H		
233	Sed 4dr-6.....	1725
232	H.T. 2dr-6.....	1825
1962-8		
SAVOY SP2-L		
313	Sed 4dr-6.....	1650
311	Sed 2dr-6.....	1625
356	Wag 4dr-6.....	1875
BELVEDERE SP2-M		
323	Sed 4dr-6.....	1750
321	Sed 2dr-6.....	1725
322	H.T. 2dr-6.....	1850
367	Wag 4dr-9.....	2025
366	Wag 4dr-6.....	1975
FURY SP2-H		
333	Sed 4dr-6.....	1875
334	H.T. 4dr-6.....	2000
332	H.T. 2dr-6.....	1975
335	Cpe Conv 2dr-6.....	2075
377	Wag 4dr-9.....	2150
376	Wag 4dr-6.....	2100
SPORT FURY SP2-P		
342	H.T. 2dr-6.....	2075
345	Cpe Conv 2dr-6.....	2200
"Optional equipment" for 1962:		
ADD-Power Brakes-Valiant.....	25	
ADD-Power Brakes-Plymouth.....	25	
ADD-Power Strg.-Valiant.....	50	
ADD-Power Strg.-Plymouth.....	50	
ADD-225" Eng.-Valiant.....	25	
ADD-361" Eng.-8 cyl.....	50	
ADD-Torque Flite Trans.: Valiant.....	95	
Plymouth 6 cyl.....	120	
DEDUCT-Std. Trans. 8 cyl.....	125	

Model	Body Type	Avg Retail
1961-6		
VALIANT V-100		
41	Sed 4dr-6.....	1150
21	Sed 2dr-6.....	1125
45	Suburban 4dr-6.....	1300
VALIANT V-200		
41	Sed 4dr-6.....	1200
23	Sed H.T. 2dr-6.....	1275
45	Suburban 4dr-6.....	1350
1961-6		
FLEET SPECIAL		
	Sed 4dr-6.....	975
	Sed 2dr-6.....	950
SAVOY RP1-L		
41	Sed 4dr-6.....	1075
21	Sed 2dr-6.....	1050
BELVEDERE RP1-M		
41	Sed 4dr-6.....	1150
23	Sed H.T. 2dr-6.....	1250
21	Sed 2dr-6.....	1125
FURY RP1-H		
41	Sed 4dr-6.....	1250
43	Sed H.T. 4dr-6.....	1375
23	Sed H.T. 2dr-6.....	1375
SUBURBANS		
DeLUXE RP1-L		
45	Sta Wag 4dr-6.....	1275
25	Sta Wag 2dr-6.....	1250
CUSTOM RP1-M		
45	Sta Wag 4dr-6.....	1325
1961-8		
FLEET SPECIAL		
	Sed 4dr-6.....	1100
	Sed 2dr-6.....	1075
SAVOY RP2-L		
41	Sed 4dr-6.....	1200
21	Sed 2dr-6.....	1175
BELVEDERE RP2-M		
41	Sed 4dr-6.....	1275
23	Sed H.T. 2dr-6.....	1375
21	Sed 2dr-6.....	1250
FURY RP2-H		
41	Sed 4dr-6.....	1375
43	Sed H.T. 4dr-6.....	1500
23	Sed H.T. 2dr-6.....	1500
27	Conv 2dr-6.....	1550
SUBURBANS		
DeLUXE RP2-L		
45	Sta Wag 4dr-6.....	1400
25	Sta Wag 2dr-6.....	1375
CUSTOM RP2-M		
45	Sta Wag 4dr-9.....	1500
45	Sta Wag 4dr-6.....	1450
SPORT RP2-H		
45	Sta Wag 4dr-9.....	1550
45	Sta Wag 4dr-9.....	1500
"Optional equipment" for 1961:		
	ADD-Power Brakes.....	20
	ADD-Power Strg.....	40
	ADD-Torque Flite	
	Valiant.....	75
	Plymouth 6 cyl.....	95
	ADD-Power Flite over Torque	
	Flite.....	30
	DEDUCT-Std. Trans.....	95
	8 Cyl. only.....	
	ADD-361" V-8 Eng.....	40
	ADD-383" V-8 Eng.....	125
1960-6		
VALIANT V-100		
41	Sed 4dr-6.....	900
45	Sub 4dr-9.....	1075
45	Sub 4dr-6.....	1025
VALIANT V-200		
41	Sed 4dr-6.....	950
45	Sub 4dr-9.....	1125
45	Sub 4dr-6.....	1075
1960-6		
FLEET SPECIAL		
41	Sed 4dr-5.....	675
21	Sed 2dr-5.....	650
SAVOY PPI-L		
41	Sed 4dr-6.....	800
21	Sed Clb 2dr-6.....	775

Model	Body Type	Avg Retail	Model	Body Type	Avg Retail	Model	Body Type	Avg Retail	Model	Body Type	Avg Retail
BELVEDERE PP1-M			"Optional equipment" for 1959 Plymouth:			2367 Conv 2dr-5..... 3150			"Optional equipment" for 1961:		
41	Sed 4dr-6.....	875	ADD-Power Brakes..... 15			2345 Wag 4dr-9..... 3250			ADD-Power Brakes..... 25		
21	Sed Clb 2dr-6.....	850	ADD-Power Strg..... 25			2335 Wag 4dr-6..... 3175			N.A. on Tempest		
23	Sed H.T. 2dr-6.....	950	ADD-Single 4Bbl. Carb..... 15			STAR CHIEF SERIES 26			ADD-Power Strg. Tempest..... 40		
FURY PP1-H			ADD-Power Flite..... 65			2669 Sed 4dr-6..... 3075			ADD-Power Strg. Pontiac..... 50		
41	Sed 4dr-6.....	950	6 Cyl. only			2639 Vista H.T. 4dr-6..... 3225			ADD-Hydraulic-Tempest..... 95		
43	Sed H.T. 4dr-6.....	1075	ADD-Torque Flite..... 15			BONNEVILLE SERIES 28			DEDUCT-Std. Trans..... 125		
23	Sed H.T. 2dr-6.....	1075	over Power Flite			2839 Vista H.T. 4dr-6..... 3400			Pontiac only		
SUBURBAN DE LUXE PP1-L			DEDUCT-Std. Trans..... 65			2847 Cpe H.T. 2dr-6..... 3350			ADD-8 cyl. Eng. Tempest..... 95		
45	Sta Wag 4dr-6.....	1000	1958-6			2867 Conv 2dr-5..... 3575			1960-8		
25	Sta Wag 2dr-6.....	950	PLAZA			2835 Safari 4dr-6..... 3625			CATALINA-SERIES 21		
CUSTOM PP1-M			LP1-L Sed 4dr-6..... 300			GRAND PRIX SERIES 29			2119 Sed 4dr-6..... 1425		
45	Sta Wag 4dr-6.....	1075	LP1-L Sed Clb 2dr-6..... 275			2957 Cpe H.T. 2dr-5..... 3725			2139 Sed H.T. 4dr-6..... 1550		
1960-8			LP1-L Cpe Bus-3..... 225			"Optional equipment" on 1963			2111 Sed Spt 2dr-6..... 1400		
FLEET SPECIAL			SAVOY			Pontiac Series:			2137 Cpe Spt 2dr-6..... 1550		
41	Sed 4dr-5.....	850	LP1-M Sed 4dr-6..... 400			ADD-Power Brakes..... 40			2167 Cpe Conv 2dr-5..... 1600		
21	Sed 2dr-5.....	825	LP1-M Sed Spt H.T. 4dr-6..... 475			ADD-Power Strg. Tempest..... 65			STATION WAGON-SERIES 21		
SAVOY PP2-L			LP1-M Sed Clb 2dr-6..... 375			ADD-Power Strg. Pontiac..... 95			2145 Safari 4dr-9..... 1650		
41	Sed 4dr-6.....	925	LP1-M Cpe Spt H.T. 2dr-6..... 475			ADD-V-8 Eng. Tempest..... 150			2135 Safari 4dr-6..... 1600		
21	Sed Clb 2dr-6.....	900	BELVEDERE			ADD-4 Speed Trans..... 165			VENTURA-SERIES 23		
BELVEDERE PP2-M			LP1-H Sed 4dr-6..... 425			ADD-4 Speed Trans..... 200			2339 Sed H.T. 4dr-6..... 1600		
41	Sed 4dr-6.....	1000	LP1-H Sed Spt H.T. 4dr-6..... 500			Pontiac..... 180			2337 Cpe H.T. 2dr-6..... 1600		
21	Sed Clb 2dr-6.....	975	LP1-H Sed Clb 2dr-6..... 400			ADD-Auto. Trans. Tempest..... 180			STAR CHIEF-SERIES 24		
23	Sed H.T. 2dr-6.....	1075	LP1-H Cpe Spt H.T. 2dr-6..... 500			DEDUCT-Std. Trans.-8 cyl..... 200			2419 Sed 4dr-6..... 1525		
FURY PP2-H			SUBURBAN			1962-4			2439 Sed H.T. 4dr-6..... 1650		
41	Sed 4dr-6.....	1075	LP1-M Custom 4dr-6..... 450			TEMPEST-SERIES 21			2411 Sed Spt 2dr-6..... 1500		
43	Sed H.T. 4dr-6.....	1200	LP1-M Custom 4dr-9..... 475			2119 Sed 4dr-6..... 1700			BONNEVILLE-SERIES 28		
23	Sed H.T. 2dr-6.....	1200	LP1-M Custom 2dr-6..... 425			2127 Cpe 2dr-6..... 1675			2839 Sed H.T. 4dr-6..... 1775		
27	Cpe Conv-6.....	1250	LP1-H Sport 4dr-6..... 500			2117 Cpe Spt 2dr-6..... 1775			2837 Cpe H.T. 2dr-6..... 1775		
SUBURBAN DE LUXE PP2-L			LP1-H Sport 4dr-9..... 525			2167 Cpe Conv 2dr-5..... 1950			2867 Cpe Conv 2dr-5..... 1850		
45	Sta Wag 4dr-6.....	1050	LP1-L DeLuxe 4dr-6..... 400			2135 Wag 4dr-6..... 1950			BONNEVILLE STA. WAG.-		
25	Sta Wag 2dr-6.....	1000	LP1-L DeLuxe 2dr-6..... 375			1962-8-PONTIAC			SERIES 27		
CUSTOM PP2-M			1958-8			2369 Sed 4dr-6..... 2325			2735 Safari Cus 4dr-6..... 1850		
45	Sta Wag 4dr-9.....	1150	PLAZA			2339 H.T. 4dr-6..... 2450			"Optional equipment" for 1960 Pontiac:		
45	Sta Wag 4dr-6.....	1100	LP2-L Sed 4dr-6..... 425			2311 Sed 2dr-6..... 2275			ADD-Power Brakes..... 20		
SPORT PP2-H			LP2-L Sed Clb 2dr-6..... 400			2347 H.T. 2dr-6..... 2400			ADD-Power Strg..... 45		
45	Sta Wag 4dr-6.....	1225	LP2-L Cpe Bus-3..... 350			2367 Cpe Conv 2dr-5..... 2650			DEDUCT-Std Trans..... 95		
"Optional equipment" for 1960 Plymouth:			SAVOY			2345 Wag 4dr-9..... 2675			1959-8		
ADD-Power Brakes..... 20			LP2-M Sed 4dr-6..... 525			2335 Wag 4dr-6..... 2625			CATALINA-21 SERIES		
ADD-Power Strg..... 30			LP2-M Sed Spt H.T. 4dr-6..... 600			STAR CHIEF-SERIES 26			2119 Sed 4dr-6..... 1125		
ADD-361" V-8 Eng..... 15			LP2-M Sed Clb 2dr-6..... 500			2669 Sed 4dr-6..... 2500			2139 Sed H.T. 4dr-6..... 1225		
ADD-383" V-8 Eng..... 20			LP2-M Cpe Spt H.T. 2dr-6..... 600			2639 H.T. 4dr-6..... 2625			2111 Sed Spt 2dr-6..... 1100		
ADD-Torque Flite..... 75			BELVEDERE			BONNEVILLE-SERIES 28			2137 Cpe H.T. 2dr-6..... 1225		
6 Cyl. only			LP2-H Sed 4dr-6..... 575			2839 H.T. 4dr-6..... 2850			2167 Cpe Conv 2dr-6..... 1275		
ADD-Torque Flite over Power			LP2-H Sed Spt H.T. 4dr-6..... 650			2847 H.T. 2dr-6..... 2825			STATION WAGONS		
Flite-8 Cyl. only..... 15			LP2-H Sed Clb 2dr-6..... 550			2867 Cpe Conv 2dr-5..... 2975			2135 Safari 4dr-6..... 1325		
DEDUCT-Std. Trans..... 75			LP2-H Cpe Spt H.T. 2dr-6..... 650			BONNEVILLE S/WAG-SERIES 27			2145 Safari 4dr-9..... 1375		
8 Cyl. only			LP2-H Cpe Conv-6..... 675			2735 Custom 4dr-6..... 2975			STAR CHIEF-24 SERIES		
1959-6			SUBURBAN			GRAND PRIX-SERIES 29			2419 Sed 4dr-6..... 1175		
SAVOY MP1			LP2-M Custom 4dr-6..... 575			2947 H.T. 2dr-5..... 2975			2439 Sed H.T. 4dr-6..... 1275		
41	Sed 4dr-6.....	600	LP2-M Custom 4dr-9..... 600			"Optional equipment" for 1962:			2411 Sed Spt 2dr-6..... 1150		
21	Sed Clb 2dr-6.....	575	LP2-M Custom 2dr-6..... 550			ADD-Power Brakes*..... 30			BONNEVILLE-28 SERIES		
22	Cpe Bus-3.....	475	LP2-H Sport 4dr-6..... 625			ADD-Power Strg-Tempest..... 50			2839 Sed H.T. 4dr-6..... 1450		
BELVEDERE MP1-M			LP2-H Sport 4dr-9..... 650			ADD-Power Strg-Pontiac..... 65			2837 Cpe H.T. 2dr-6..... 1450		
41	Sed 4dr-6.....	650	LP2-L DeLuxe 4dr-6..... 525			ADD-215" Eng. Tempest..... 150			2867 Cpe Conv 2dr-5..... 1500		
43	Sed H.T. 4dr-6.....	725	LP2-L DeLuxe 2dr-6..... 450			ADD-Auto. Trans.-Tempest..... 125			CUSTOM STATION WAGON-		
21	Sed Clb 2dr-6.....	625	FURY			DEDUCT-Std. Trans. 8 cyl..... 150			27 SERIES		
23	Cpe H.T. 2dr-6.....	725	LP2-H Cpe Spt H.T. 2dr-6..... 675			*Not available on Tempest			2735 Safari 4dr-9..... 1500		
SUBURBAN			"Optional equipment" for 1958 Plymouth:			1961-4			"Optional equipment" for 1959 Pontiac:		
45A	Custom 4dr-6.....	750	ADD-Power Brakes..... 15			TEMPEST 161-SERIES 21			ADD-Power Brakes..... 20		
45A	DeLuxe 4dr-6.....	700	ADD-Power Strg..... 20			2119 Sed 4dr-6..... 1325			ADD-Power Strg..... 40		
25	DeLuxe 2dr-6.....	675	ADD-Overdrive..... 20			2127 Cpe Std 2dr-6..... 1300			ADD-315 HP Eng..... 15		
1959-8			ADD-350 Eng..... 15			2117 Cpe Cus 2dr-6..... 1425			DEDUCT-Std. Trans..... 65		
SAVOY MP2-L			ADD-Power Flite 5 Cyl. only..... 50			2135 Safari 4dr-6..... 1450			1958-8		
41	Sed 4dr-6.....	700	ADD-Torque Flite over			1961-8			CHIEFTAIN		
21	Sed Clb 2dr-6.....	675	Power Flite..... 15			CATALINA 361-SERIES 23			2749 Sed 4dr-6..... 650		
BELVEDERE MP2-M			DEDUCT-Std. Trans..... 50			2369 Sed 4dr-6..... 1800			2739 Catalina 4dr-6..... 725		
41	Sed 4dr-6.....	750	PONTIAC			2339 Sed H.T. 4dr-6..... 1925			2741 Sed 2dr-6..... 625		
43	Sed H.T. 4dr-6.....	825	Auto. Trans. Included (Exc. 6 Cyl.)			2311 Sed Spt 2dr-6..... 1750			2731 Catalina 2dr-6..... 725		
21	Sed Clb 2dr-6.....	725	1963-4			2337 Cpe H.T. 2dr-6..... 1925			2567 Cpe Conv-5..... 775		
23	Cpe H.T. 2dr-6.....	825	TEMPEST-SERIES 21			2367 Conv 2dr-5..... 2000			2793 Safari 4dr-6..... 800		
27	Cpe Conv 2dr-6.....	850	2119 Sed 4dr-6..... 2100			2345 Safari 4dr-9..... 2075			2794 Safari 4dr-9..... 825		
FURY MP2-H			2127 Cpe 2dr-6..... 2050			2335 Safari 4dr-6..... 2025			SUPER CHIEF		
41	Sed 4dr-6.....	850	2117 Cpe Spt 2dr-6..... 2150			VENTURA 561-SERIES 25			2849D Sed 4dr-6..... 700		
43	Sed H.T. 4dr-6.....	925	2167 Conv 2dr-5..... 2375			2539 Sed H.T. 4dr-6..... 2000			2839D Catalina 4dr-6..... 775		
23	Cpe H.T. 2dr-6.....	925	2135 Wag 4dr-6..... 2325			2537 Cpe H.T. 2dr-6..... 2000			2831D Catalina 2dr-6..... 775		
SPORT FURY MP2-P			1963-8			STAR CHIEF 661-SERIES 26			STAR CHIEF		
23	Cpe H.T. 2dr-6.....	975	CATALINA SERIES 23			2669 Sed 4dr-6..... 1975			2793SD Safari 4dr-6..... 875		
27	Cpe Conv 2dr-6.....	1000	2369 Sed 4dr-6..... 2825			2639 Sed H.T. 4dr-6..... 2100			BONNEVILLE		
SUBURBAN			2339 Vista H.T. 4dr-6..... 2975			BONNEVILLE 861-SERIES 28			2547SD Cpe Spt Cus-5..... 900		
45A	DeLuxe 4dr-6.....	775	2311 Sed Spt 2dr-6..... 2775			2839 Sed Vista 4dr-6..... 2225			2567SD Cpe Conv Cus-5..... 925		
45A	Custom 4dr-6.....	825	2347 Cpe Spt 2dr-6..... 2900			2837 Cpe H.T. 2dr-6..... 2225			"Optional equipment" for 1958 Pontiac:		
45B	Custom 4dr-9.....	850	1961-8			2867 Conv 2dr-5..... 2275			ADD-Power Brakes..... 15		
45A	Sport 4dr-6.....	875	CATALINA 361-SERIES 23			BONNEVILLE STA. WAG. 761-			ADD-Power Strg..... 30		
45B	Sport 4dr-9.....	900	2369 Sed 4dr-6..... 2825			SERIES 27			DEDUCT-Std. Trans..... 50		
25	DeLuxe 2dr-6.....	750	2339 Vista H.T. 4dr-6..... 2975			2735 Safari Cus. 4dr-6..... 2325					
25	Custom 2dr-6.....	775	2311 Sed Spt 2dr-6..... 2775								
			2347 Cpe Spt 2dr-6..... 2900								

Say 'aah'



What is this man doing? For the answer, turn the page



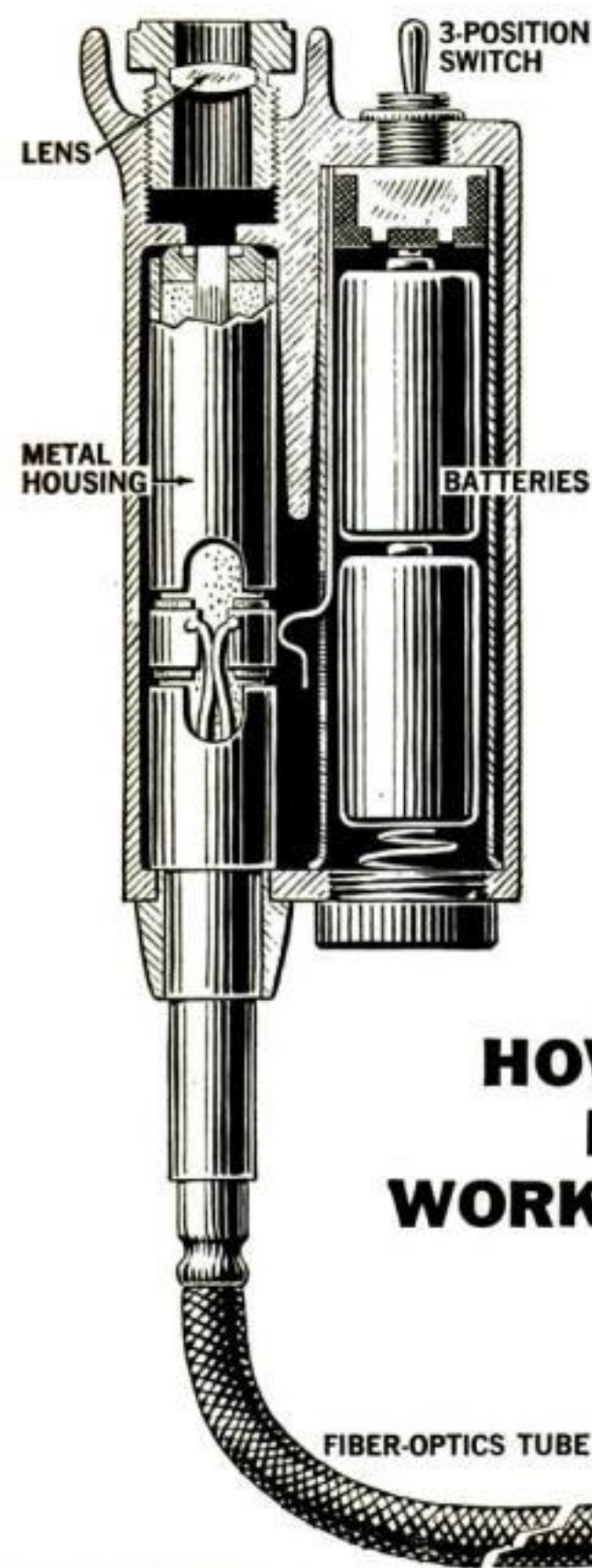
What the Man on the Preceding Page Is Looking At

NO, THE man in the white coat is not Ben Casey. He is a "Doctor of Motors" and he is studying the gastrointestinal tract of an automatic transmission with a new instrument called a Flexiscope. What he sees is the condition of a threaded shaft inside the transmission, shown above in a photograph actually taken through the instrument by POPULAR SCIENCE.

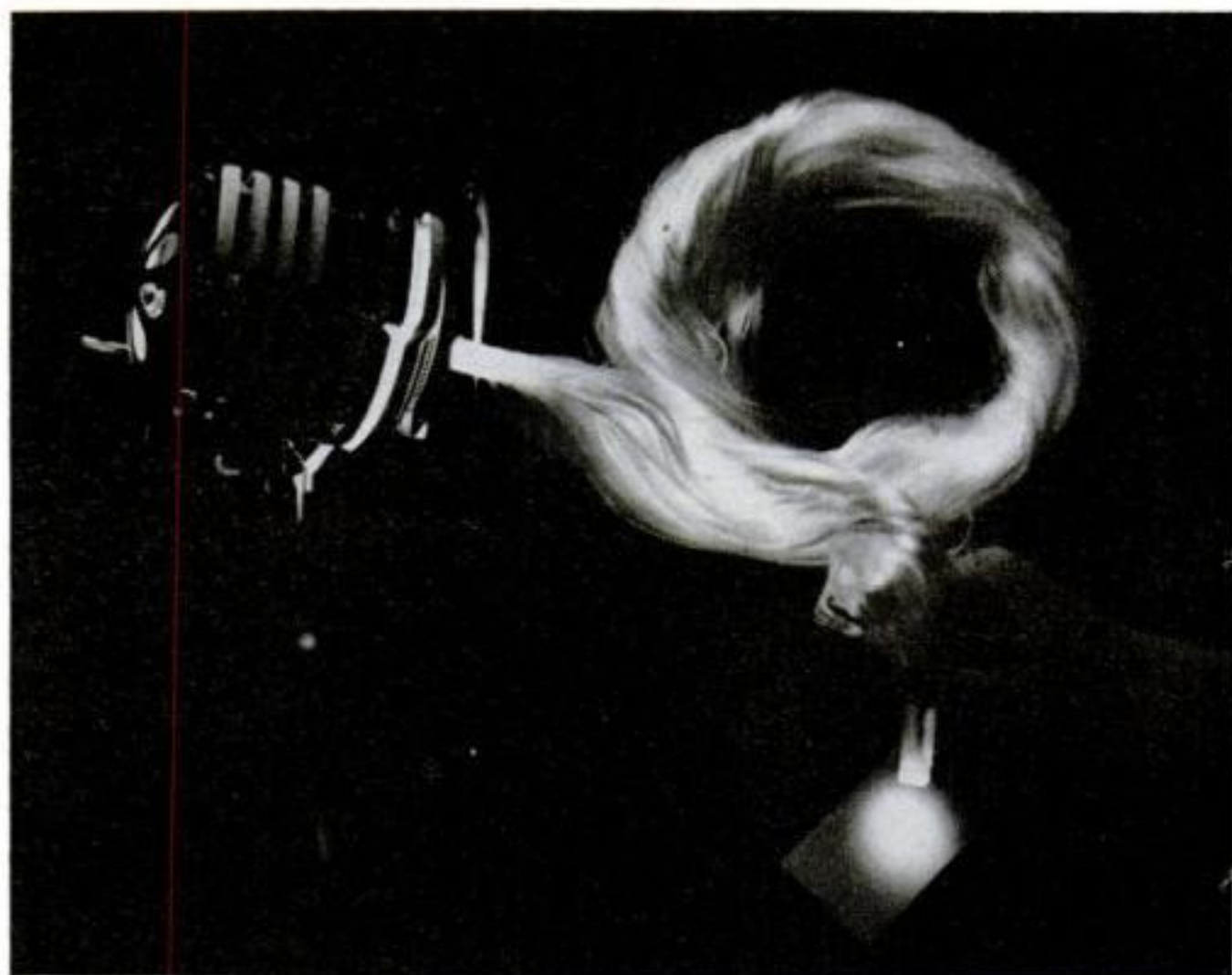
The new device, made by Bausch & Lomb, is an optical probe that literally lets you see around corners, into holes, and in the dark. You can put your watch in a desk drawer, insert the probe, close the drawer, and tell what time it is. The Flexiscope is

priced at \$250—peanuts compared with the cost of custom-built products using fiber optics. Fiber optics? Inside the flexible plastic tubing is a bundle of 100,000 glass fibers, each finer than a human hair. At each end of the probe the fibers are clustered together, the ends bonded, ground, and polished. Two light bulbs also fit its tip. Light entering the fibers travels the length of the glass "wires" by total internal reflection.

The electronic probe may get widespread use as an inspection device to save tear-down time—when makers of machinery provide the inspection holes. ■ ■



HOW IT WORKS

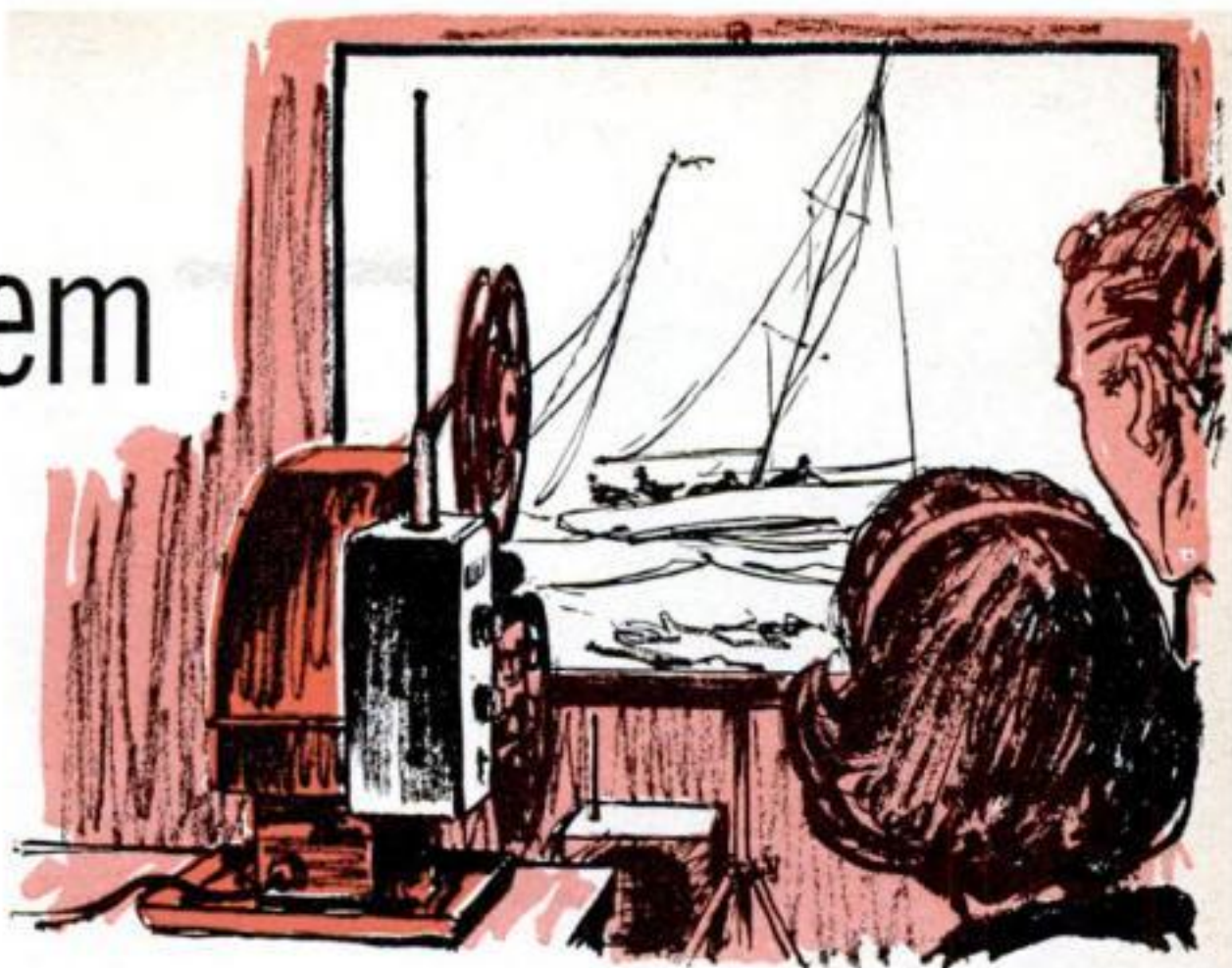


Extremely fine glass fibers contained in the Flexiscope probe transmit light (or an image) even when twisted into a knot, as above. The ends of each fiber are aligned so that when an image is formed on one of the bonded, ground, and polished ends of the bundle, a mosaic of the image will appear on the other. The bundles, encased in flexible tubing to protect the fibers, are attached to the metal housing of the Flexiscope which contains a focusing eyepiece. Batteries in the instrument merely power two tiny light bulbs that illuminate the viewing area at the probe end. About one square inch of area can be viewed.

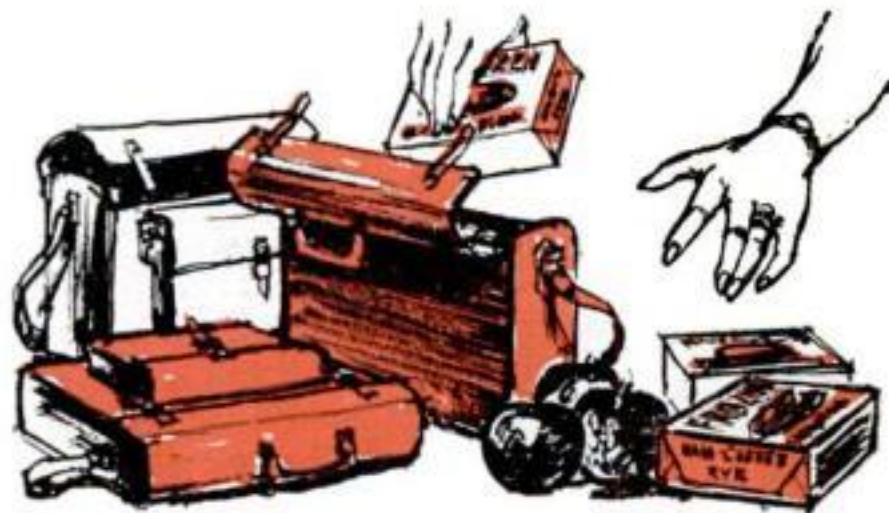


"I'd like to see them make..."

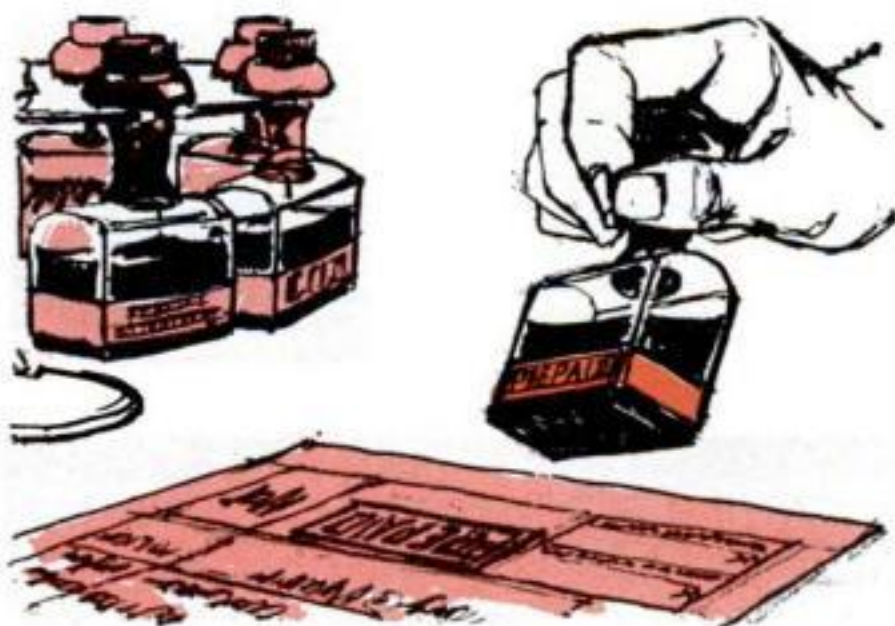
Broadcasting projectors for sound movies. Put a radio transmitter in the projector and a receiver in the speaker enclosure, and you'd eliminate the cable.—Charles R. DeKay, Grenada, Miss.



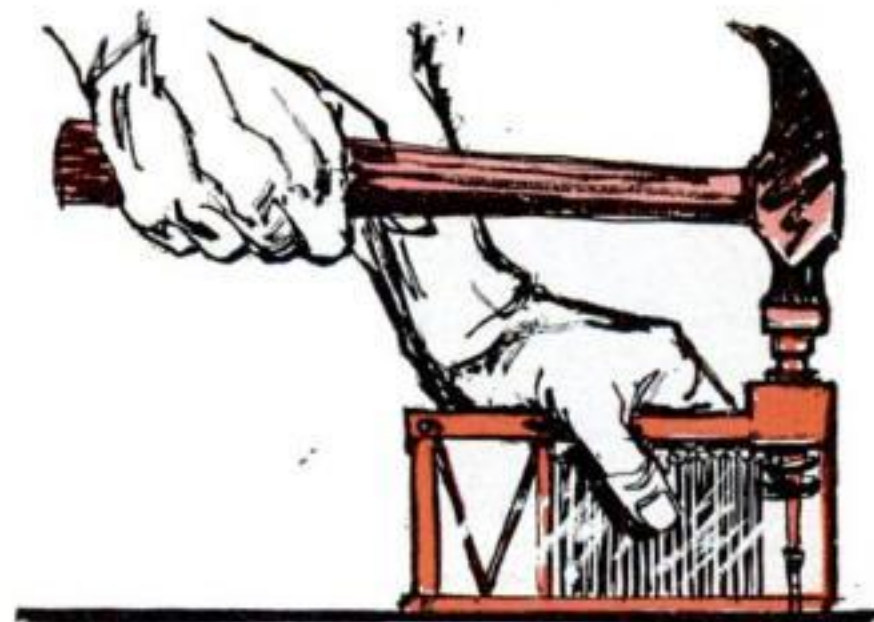
Light-reflecting trim on the sides of cars, designed to be part of the standard trim. Luminous plastic edging the chrome might do the job.—David F. Tufaro, Hartsdale, N.Y.



Quick-frozen lunches in disposable cartons—a boon to the sandwich detail. Pop them into the schoolbags in the morning and they'd thaw by noon.—Mrs. E. Miller, Lansing, Mich.



Fountain stamps with porous letters and a refillable ink reservoir. Clerks who stamp hundreds of forms daily wouldn't waste motion swatting at a pad.—H. M. Monaghan, NYC.



Spring-loaded nail feeders. As each nail popped into final position, a shaft or anvil would drop on the head. Pound it down and it would set the nail, too.—J. Myers, Sylvania, Ohio.

Everyone has his own pet idea of a gadget that he would like to see in general use. What's yours? We will pay \$5 for each one published. Please use Government postcards

only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 17. Write your name and address clearly. Contributions cannot be acknowledged or returned.



Split-open sports coupe

The sting is in the tail of the British-made Deep Sanderson coupe. It's a transversely mounted 60.85-inch, 55-hp. Mini-Cooper engine stacked over the gearbox. Shift linkage is hydraulic; four master cylinders at the stick relay movements to slave cylinders working the selector lever. The 11-foot-long, 900-pound plastic-bodied car does 0 to 60 in 9.4 seconds. U.S. price will be about \$2,250 plus shipping.

◀ Entire rear of body opens for quick access to engine, drive train, and the rear suspension.

Foreign Sportsters: FAST AND FANCY



Simca special for street and track

The aluminum-bodied Abarth-Simca 1300 coupe is built in Italy with modified French parts. The rear-mounted 78.6-inch Simca four develops 125 hp. at 7,400 r.p.m. with the help of dual overhead cams, two carbs, and 10.4:1 compression ratio. Top speed is over 140 m.p.h. The Simca 1000 suspension is retained, but with four-wheel disk brakes. In Italy: \$6,400. A larger-displacement version also is made.



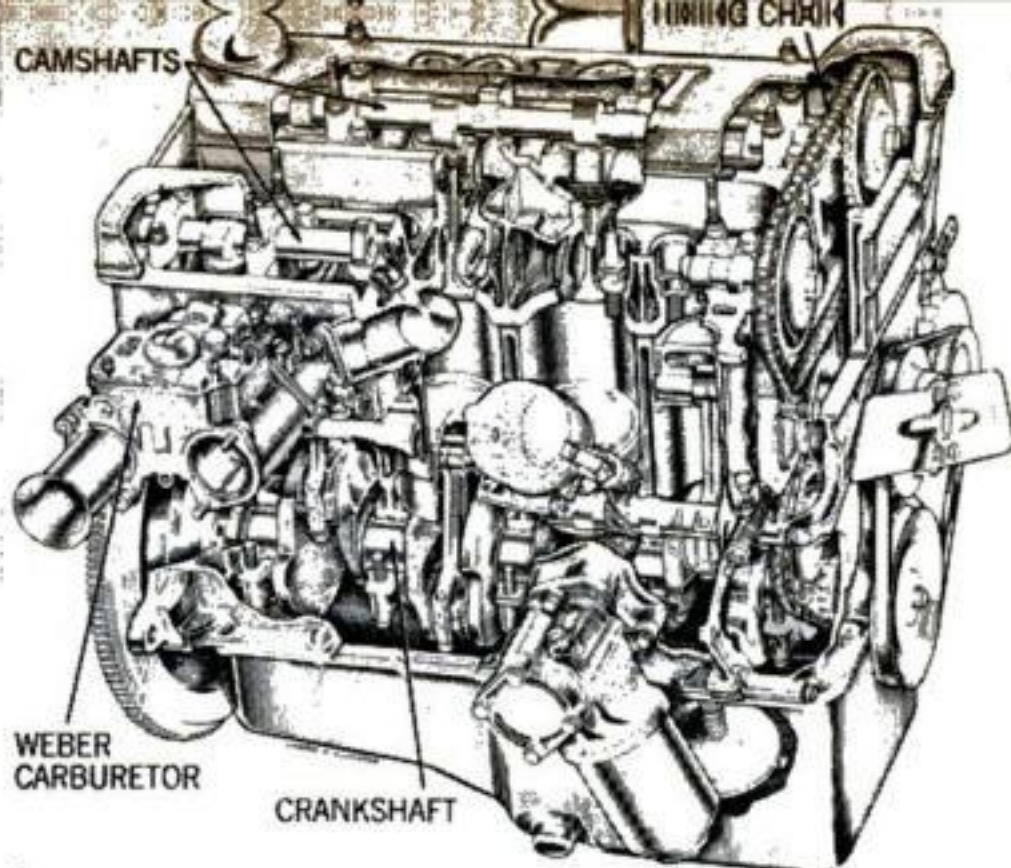
Face-lift for Fiat

The front end of the Fiat 1600 S roadster has been re-designed with scoopless hood and quad lights. The four-wheel disk brakes now have a regulator to balance braking action of rear wheels.



Fastest British Ford

The Consul Cortina Sports Special looks meek, but it can top 115 m.p.h. Its 95-inch Ford four, with Lotus twin overhead cams, two Weber carbs, and strengthened five-bearing crankshaft, produces 105 hp.—enough to pull the car from 0 to 100 in 30 seconds. Front disk brakes are vacuum-as-

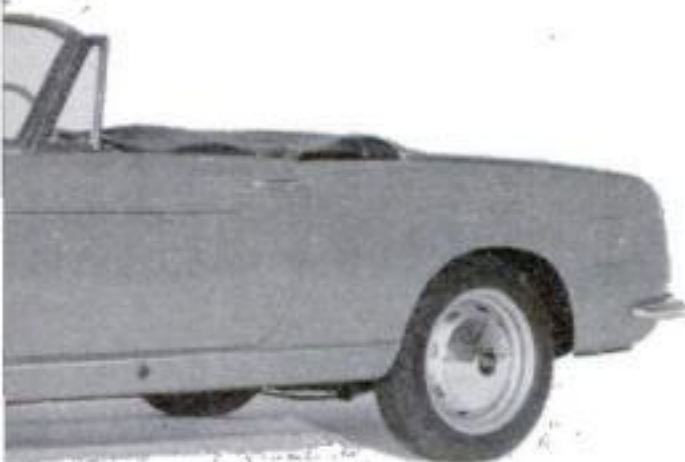


Overhead cams allow short pushrods, resulting in less friction and weight—and better performance.

sisted. Coils replace standard rear leaf springs. Interior has wood-rimmed wheel and tachometer. Cost in England: \$3,100.

New Mercedes sports car

A new roadster, the 230SL, has been introduced by Mercedes-Benz to replace the 190SL and 300SL. The 140.7-inch, overhead-cam, fuel-injected six produces 170 hp. It comes with a four-speed gearbox; an automatic is optional. The German car does 124 m.p.h., and reaches 60 in under 10 seconds. It will go into production late this year. U.S. prices: roadster, \$7,506; coupe, \$7,625; roadster with removable hardtop, \$7,907.



Also featured is a fan that cuts out when not needed. The 95.7-inch, 100-hp. dual-overhead-cam four allows a 108-m.p.h. top speed. The car costs about \$2,800 in Italy. It isn't sold here.



New Alfa Romeo gets a bigger engine

There's a lively addition to Alfa Romeo of Italy. The new Giulia series outwardly resembles the Giulietta except for a hood with air scoop. Engine displacement is up 17 inches to 95.8. The 104-hp. aluminum dual-overhead-cam four is fitted with a fully synchronized five-speed gearbox. Top speed is 107 m.p.h. Roadster (Spyder), coupe (Sprint), and sedan (TI) are available. Prices start at \$3,395.

New ideas from the inventors

Car seat slides you in. Instead of squirming in and out of a taxi or other low-roofed car, invalids and oldsters (and even agile folks) could ride comfortably to or from the sidewalk on this recently patented slide seat. Flanged tracks under the seat and transverse rails on the car floor would let the driver move the motorized platform in or out.



Guard guides paintbrush. To simplify painting of window frames, wall moldings, and other trim, this brush guard would limit the length of exposed bristles and guide them along the edge of the wood. The slip-on sleeve and sliding, thumbscrew-adjusted guide would serve also to confine the bristles and keep them from spreading.



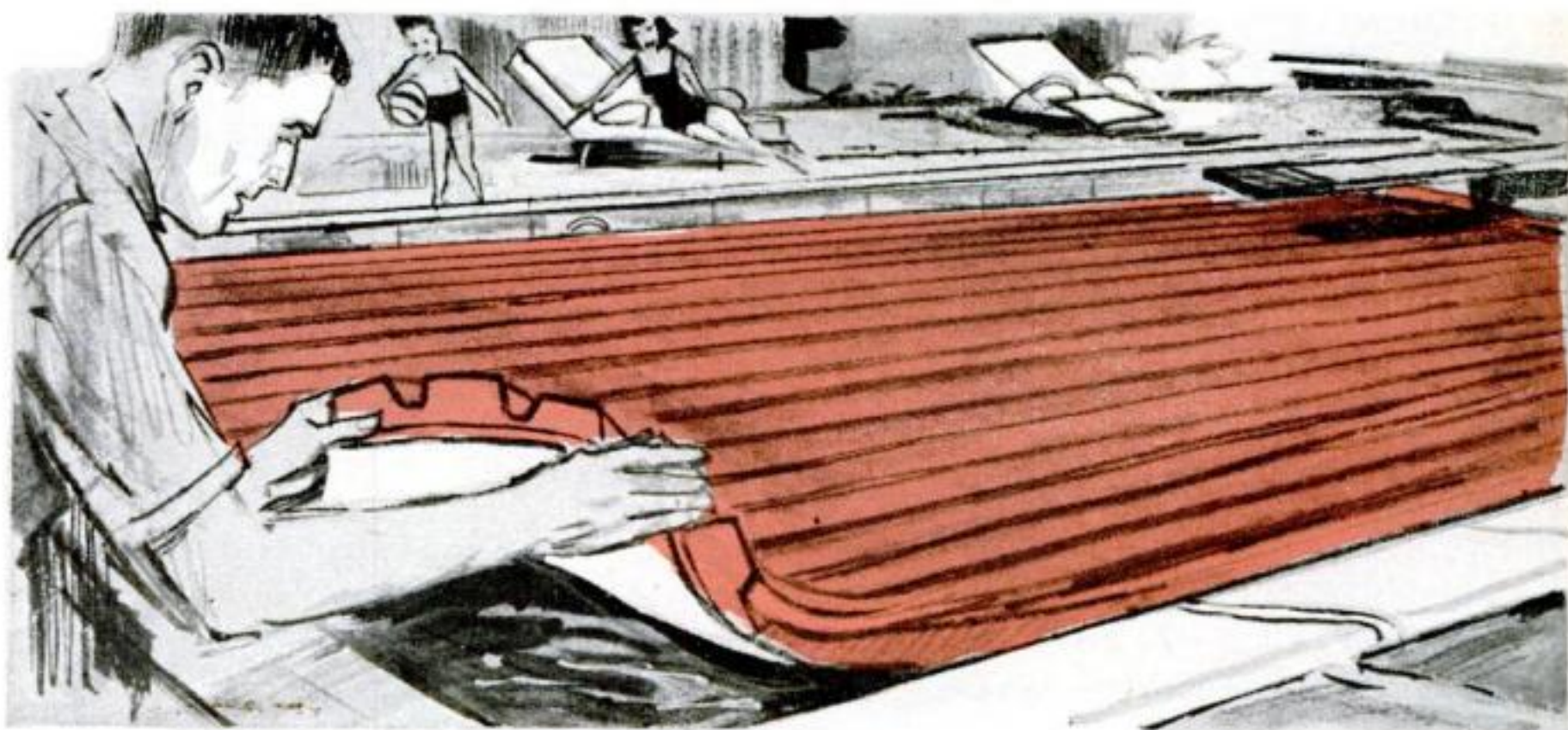
Cord switch controls plug-ins. You could turn on a lamp, TV set, fan, air conditioner, or other appliances from one convenient place by plugging them into this remote-control extension. Three or more outlets in the assembly would be connected by a cable of appropriate length to individual switches in a control box.



Record Case Loads Changer. You could keep records permanently stacked in any order, ready to play, with this case—then load 'em all at a time onto a record changer. After slipping off the top of the case, you'd slide the notch to engage the changer spindle, lower the discs, and pull the case away.



Gun extension speeds calking. A pawl-and-ratchet mechanism in this gun would draw back the cylinder against a stationary piston to squeeze out mastic with more pressure for less effort. The mechanical assist could make it practical to apply mastic from the end of an extension pole.



Pool cover heats water. This pool cover with air pockets might extend the swimming season far into the fall. One side of the plastic mattress would be covered with

a dark film to absorb solar heat and transmit it to the water. The light-colored heat reflector on the reverse side would help cool the water in the summer.

The following patents have been issued on these inventions: Car seat—No. 3,071,407 to F. C. Sloan, Bellingham, Wash.; Brush guide—No. 3,049,741 to A. R. Besette and R. N. Martin, Warwick, R.I.; Remote switch—No. 2,979,624 to W. Askerneese, Sharon, Pa.; Record case—No. 3,070,223 to Otto Kluck, Ihme, near Hanover, Germany; Calking gun—No. 3,070,827 to R. G. Ames,

Hillsborough, Calif.; Pool cover—No. 3,072,920 to J. I. Yellott, Phoenix, Ariz.

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.

After two months of the most extensive listening tests ever made by a magazine, PS gives you—

THE LOW-DOWN ON HI-FI STEREO

Our listening room was packed with a variety of hi-fi stereo equipment. An average living room was chosen for tests so acoustic conditions would match those for typical listening.





Listening tests spanned two months. Authors Gilmore and Lockett are shown here during one

session. Four other hi-fi experts served on panel. Equipment choices were made independently.

- Can around \$100 buy a good system?
- How much must you spend to get the best?
- Do you always "get what you pay for"?
- Which components make the biggest difference?

By C. P. Gilmore
and Hubert Lockett

HEAD spinning over stereo? No wonder. You can spend anything from \$59.95 to well over \$1,000 for the equipment to play stereo records in your living room. The cheap player will play exactly the same records as the most expensive, deluxe system—and they'll both be called "hi-fi stereo."

Picking the best record player for the money has become an almost impossible job for the individual shopper. The words on the labels have lost all meaning. Even if you are convinced in advance that you want a system of separate components, you are still faced with a choice among hundreds of individual pieces of equipment, thousands of possible combinations.

Naturally, each manufacturer claims his product is the best—and often produces technical specifications to prove it. But specs can't really tell you much.

Even price is only a rough guide to quality and is sometimes deceptive.

To bring some sense to an area where so much nonsense abounds, POPULAR SCIENCE conducted an independent research project including the most extensive series of hi-fi listening tests ever conducted by a magazine. Our goals:

- To pick a low-priced system that would be the cheapest you can buy yet still give you musically acceptable sound by true high-fidelity standards.

- To choose a system that would please the ears of the most discriminating music lover without overstraining his pocketbook.

- To select a system that would satisfy the demanding standards of a seasoned hi-fi hobbyist, without wasting money on frills that add little or nothing to the sound you hear.

We invited every leading manufacturer to submit equipment for the project. (A very few chose not to participate, but we checked out their equipment

anyway, informally, to be sure we didn't miss an outstanding buy.) Within broad limitations that we set up to define our goals, the manufacturers were free to choose which of their products to submit. We arbitrarily limited the speakers to those in the compact class, because finding room for the big ones is a problem in most homes.

Because room conditions—rugs, drapes, furniture, windows, bare walls, etc.—affect the sound, tests were conducted in an average living room, acoustically similar to those in the majority of homes. Loudspeakers were stacked in two piles near one end. Since corner placement of a loudspeaker emphasizes bass response, all speakers were kept away from the corner so that all would have an equal break.

At the other end of the room, we built a large rack to hold all of the amplifiers and turntables. In the center of the rack, within easy reach of the listener, was a switching panel. Any five turntables, three amplifiers, and five pairs of loudspeakers could be plugged into the switching panel at one time. By flipping controls, the operator could switch to any turntable, any amplifier, or any pair of speakers. (Audio experts call this an A-B test.) The sound of any single com-

Tiny Heath AS-81 speakers produced surprisingly high-quality sound for their size. The panel considered them an excellent choice for any situation demanding a small speaker.



The Lafayette 224 is an alternate choice for those who don't want to build a kit amplifier. It has a pre-amp for magnetic cartridges if you prefer the Shure M3D's silkier sound.

ponent could therefore be compared instantly with any other.

Many magazine articles have recommended equipment on the basis of technical measurements. POPULAR SCIENCE panelists, on the other hand, judged the components and complete systems almost entirely on the quality of the sound they produced. There were two reasons for this approach. First, the ultimate purpose of all audio equipment is to produce sound—not readings on a voltmeter. There is still no instrument that can measure the overall performance of a piece of high-fidelity equipment nearly so well as the trained human ear. Second, technical measurements are frequently hard to interpret. One amplifier, for example, may have better frequency response; another, better distortion measurements. Which do you choose? The experienced listener can tell quickly whether one *sounds* better than the other, or whether the differences are too small to hear.

While panel members made their judgments primarily on the basis of complete systems rather than single components, the individual amplifiers, turntables, speakers, and cartridges were, of course, checked. Before any component could be considered as part of a system, it had to be judged basically capable of producing high-fidelity sound.

Here, in general, is what the jury

\$125



System I, the economy system, ranges in price from \$108.46 to \$166.41. There are two basic variations of the system, and some choice of speaker finishes and mounts for the record changer, that account for the differences in cost.

The lowest-priced version has no frills or extras—just the bare necessities for good sound. The amplifier must be built from a kit. The speakers are in unfinished birch. It consists of a Garrard Autoslim record changer, Sonotone 9TA-SD cartridge, Knight-Kit KG-240 amplifier, and two Cabinart Mark III speakers. Cost: \$108.46. Adding a walnut record-changer base (\$4.95), an amplifier case (\$3.95), and oil-finished walnut on both speakers (\$33) brings

the total cost of the system up to \$150.36.

An alternate system was chosen mainly to satisfy those who don't want to build a kit amplifier. The ready-made amplifier selected also has a pre-amp for use with a magnetic cartridge. With the pre-amp available, some panel members (but not all) felt that a magnetic cartridge made enough improvement in the sound to be worth the difference in cost. A Shure M3D cartridge was chosen. It lists for \$45, but has been offered for as low as \$15.88 when bought separately, and has also been featured by several mail-order houses in one-cent sales with the purchase of a changer. The ready-made amplifier selected is a Lafayette 224 at \$49.95.

members looked for in each component:

Amplifiers. Every amplifier tested had to meet the two basic criteria of high-fidelity equipment: low distortion and wide frequency range. A perfect amplifier should take a very small electrical signal—far too small to hear—and build it up into a very large signal strong enough to drive a loudspeaker. In the process, it should not change the signal in any way except size.

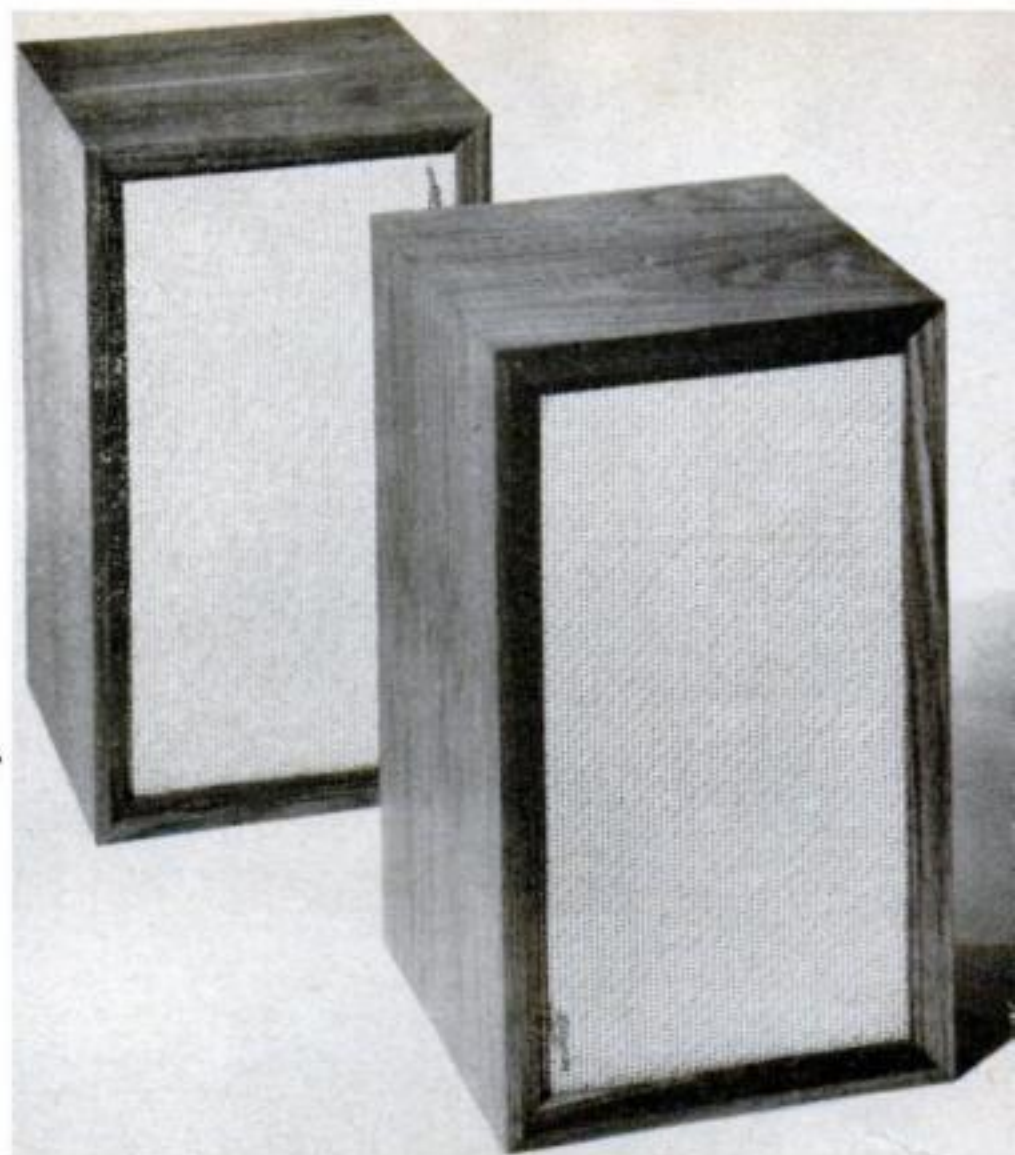
Although all amplifiers produce *some* distortion, true high-fidelity jobs distort so little that you shouldn't hear it at all. A low-distortion amplifier produces clean, crisp, startlingly natural sound. This was the first thing panel members listened for.

Wide frequency response was next. If your ears are like most people's, you can hear vibrations in the air—sounds—as low as 20 or so cycles per second or as high as about 15,000 c.p.s. Music contains all these frequencies. And an amplifier that is to produce natural-sounding—high-fidelity—music must be able to reproduce sounds over the full range of human hearing. Music played through an amplifier that doesn't reproduce the higher frequencies doesn't have the sparkling brilliance of live music. If the amplifier has poor bass response, the music sounds thin. If the amplifier's response is not *flat*—that is, if it doesn't amplify all sounds equally regardless of frequency—it makes the music unnatural sounding in other ways.

One other amplifier characteristic—power output—is important in determining how an amplifier will perform in a given system. Here the judges' decisions were based on a simple test: Does the amplifier put out enough power to drive the speakers that will be used with it?

In recent years, the high-fidelity industry has tended toward a "horse-power race." Advertising implies that the bigger an amplifier, the better. But this isn't necessarily so.

Some speakers are much more efficient than others. High-efficiency units are not necessarily better than low-efficiency ones—designers of the latter have just



Lafayette SY 401X speakers sounded better than some far more costly ones. Although they don't measure up to all more-expensive speakers, they're a good buy at \$66.50 each.

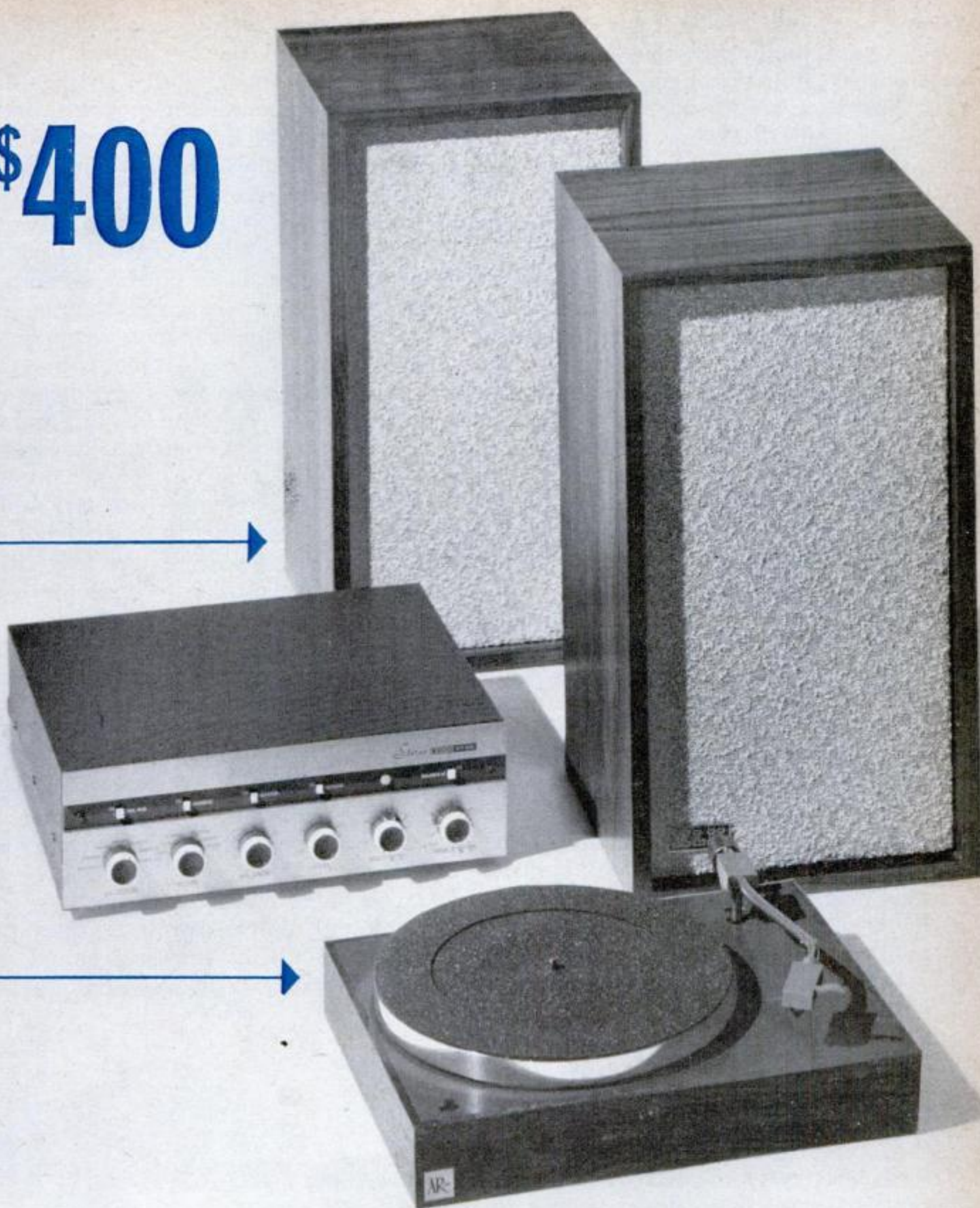


The Garrard Autoslim is the choice in this price range if you prefer a changer. Disadvantages over the turntable: more speed variation, noise, record wear. But it's cheaper.

traded off efficiency for some other desirable characteristic. From the listener's standpoint, the only difference is that the low-efficiency units require bigger amplifiers to produce the same volume.

The POPULAR SCIENCE panel judged the adequacy of each amplifier's power

\$400



System II, the music-lover's system, will cost somewhere between \$391 and \$471. The amplifier recommended comes either as a kit you can build or in factory-wired form ready to play. You have a choice between an automatic record changer and a manual turntable. If purity of sound and least record wear are more important to you than the convenience of playing several records automatically, you will choose the manual turntable. The changer, though, is a good bargain—especially if you take advantage of the

many one-cent sales that give you the recommended cartridge for a penny when you buy the record changer—and many listeners don't notice the difference in sound quality.

The panelists' first choice in this group consists of an AR turntable with tone arm, Eico St-40 amplifier, Shure M3D cartridge, and two KLH-6 speakers in unfinished birch. If you wire the kit amplifier yourself, the price comes to \$391.83. A factory-wired job will add \$50 and two walnut speakers will cost another \$30.

output simply on the basis of whether or not it produced enough sound with the speaker it was to be used with.

Speakers. Loudspeakers must pass the same basic distortion and frequency-response checks as amplifiers. In general, though, speakers are not as good as amplifiers, and tend to distort more, particularly in the low bass range.

Loudspeakers also tend to show another fault rarely seen in amplifiers. Audio buffs call it "coloration." Any good amplifier has a flat frequency response beyond the limits of audibility. But this is not true of loudspeakers. Even the best ones emphasize some frequencies more than others. In a good speaker, these peaks and dips will be small and few, but they're there, and they give the speaker its particular "color." Switch instantly from one speaker to another—even among good speakers—and you'll hear the difference clearly.

The perfect speaker, of course, would be colorless. It wouldn't add anything of its own to the music. But since no such unit exists, life is tough for a speaker judge. He can only look for one with the fewest defects. The sound he seeks might be described as "smooth" or "balanced." Sharp peaks rule out a speaker—they make it sound harsh, overly bright, or strident. Large dips make it sound muffled, or perhaps unbalanced.

Cartridges. It's almost as hard to judge cartridges. Next to speakers, they color the sound more than any other component. Where the speaker turns electrical energy into mechanical motion, the cartridge turns mechanical motion—the wiggling of the needle back and forth in the groove—into an electrical signal. It's tough to design a unit that does either job well.

You want the same things in a cartridge as in a speaker: low distortion, wide frequency response, minimum coloration. But you should also judge cartridges on another basis: stylus pressure.

A cartridge must faithfully follow every wiggle in the record groove. To reproduce a 15,000-c.p.s. tone, it must move from side to side 15,000 times a

second. Most cartridges on the market can do this—if they're pushed into the record with enough force so that they must follow the twisting groove or break. In other words, if the stylus pressure is high enough, they can reproduce everything on the record.

Too much stylus pressure, though, ruins records. While there is disagreement on just how much pressure is reasonable, everyone agrees that the less, the better. This is where *compliance* comes in.

In general, a needle of very low mass in a highly compliant mounting can track perfectly at very low pressure—perhaps less than a gram. Records played at this pressure will last indefinitely. Low-compliance, heavy styli, on the other hand, may require 6, 8, 10, or even more grams. This wears out records.

Before the POPULAR SCIENCE tests were begun, all cartridges and arms were adjusted for the minimum pressure at which the stylus would track without distortion. Each stylus was checked on a special tracking-force test record. Pressure was gradually increased until all distortion disappeared. This pressure was measured to see how much force was required for good tracking.

The judges took this figure into consideration. Where two cartridges produced essentially identical sound, for

[\[Continued on page 191\]](#)



The Garrard A MK II changer, with a Shure M-99 cartridge ready-mounted in a plug-in head, is an alternate for the turntable, if you must be able to play records automatically.

\$700



System III, selected to please the true hi-fi buff, can be bought for as little as \$669.67. It was the unanimous opinion of the panel that you could spend well over \$1,000 and not get any better sound from your records. To get the system for that low price, you have to wire the amplifier from a kit and choose the unfinished version of the speakers. Neither of these economy dodges, of course, would affect the quality of the sound one whit. With factory-wired amplifier and the speakers in oil-finished walnut, the cost of this top-notch system rises to \$783.67.

The components are: a two-speed AR turntable with tone arm, Shure M-33-5 cartridge, Dynakit PAS-2 pre-amp and Stereo-70 power amplifier, and two AR-3 speakers.

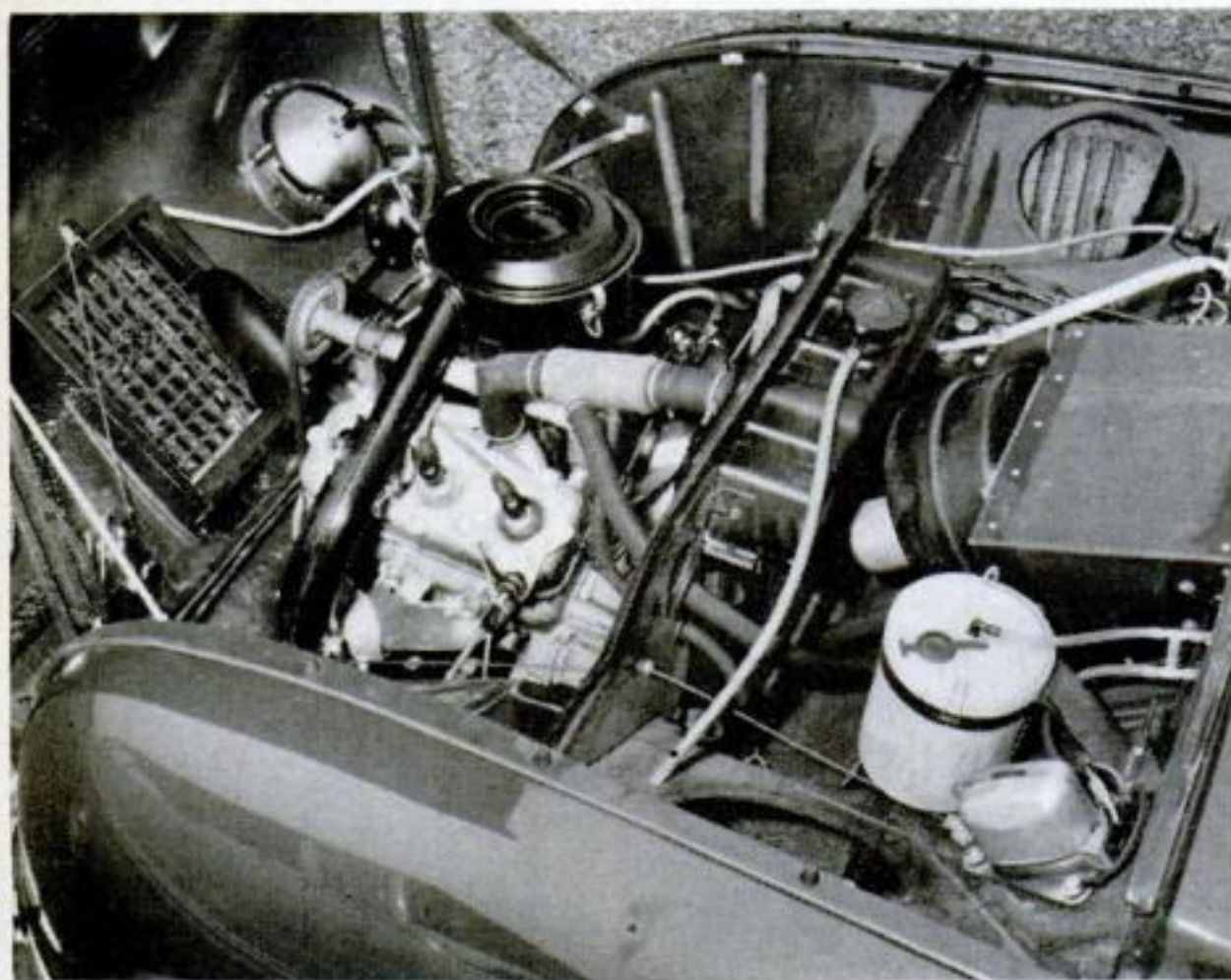
For those who want an automatic record changer, the Garrard MK II with a Shure M99 cartridge was first choice. Although the MK II usually sells for \$79.50, the base for \$4.95, and the M99 cartridge mounted in a Garrard plug-in head for \$49.50, you can find them at a discount. At least one mail-order house (Allied) offers the whole works at a package price of \$92.50.

REPORT FROM THE
DRIVER'S SEAT



Saab Story

2 cycles, 3 cylinders, front drive



◀ Hood opens wide to reveal tiny three-lunger with radiator behind. Preheater running from exhaust manifold prevents carb icing.



Dash is fully instrumented, including hard-to-read horizontal speedometer. Wiper, light, heater knobs have identifying symbols.

By Alex Markovich

A MAVERICK like the Swedish Saab 96 takes a bit of getting used to. It resembles an overgrown beetle and it idles like an unruly coffee percolator. Its handling is completely unconventional, thanks to its front-wheel drive. But take a little time to become familiar with the strange inner workings, and the car becomes so friendly you can almost see its tail wag.

If the little two-cycle engine sounds as if it's running on three cylinders, there's good reason: It has only three. It always seems on the verge of stalling when idling, but it never stalled during our test. And it smooths out beautifully under load.

The engine has excellent low-speed torque; it's not really unhappy in high gear at five m.p.h. But don't expect to beat any superstocks off the line. One inconvenience: Oil has to be mixed with the gas—one quart to eight gallons.

The optional four-speed transmission costs \$100 more than the standard three-speed, but with such a small engine it's worth it. All forward speeds are well synchronized, and shift travel is crisp, especially for a steering-column stick.

[Continued on page 214]



Who needs motels when the Saab has its own twin beds built in? Removable front and rear seats are switched and placed over optional plywood framework. Bed is short but comfortable.

FACTS ON THE SAAB 96

Model: 2-door sedan

Factory-suggested basic price: \$1,895*; price as equipped, \$2,100.*

Engine: two-cycle, three-cylinder in-line; 42 hp. at 5,000 r.p.m.; maximum torque, 59 ft.-lb. at 3,000 r.p.m.; bore and stroke, 2.76 by 2.87 in.; displacement, 51.9 cu. in.; compression ratio, 7.3:1; carburetion, 1 bbl.; weight (lb.) per hp., 42.8; engine revs per mile, 3,797; piston travel (ft.) per mile, 1,816; fuel required, regular.

Fuel capacity: 10.5 gal.

Transmission: four-speed; ratios (:1):3.56, 2.10, 1.29, 0.85; reverse, 3.24.

Axle ratio: 5.43:1. **Steering ratio:** 14:1 average. **Turns lock-to-lock:** 2¼. **Brake-swept**

area: 105 sq. in. **Tire size:** 5.00 or 5.20 by 15.

Outside dimensions: wheelbase, 98 in.; track, front and rear, 48 in.; overall length, 158 in.; width, 62 in.; height, 58 in.; ground clearance, 7.5 in.

Curb weight: 1,800 lb. **Weight distribution:** front, 58%; rear, 42%.

Speedometer error:** indicated 60 m.p.h. is actual 54 m.p.h. **Odometer error**:** +10%.

Gas mileage at constant speeds (gallons):** 30 m.p.h., 37.8; 40 m.p.h., 35.9; 50 m.p.h., 32.6; 60 m.p.h., 29.4.

Acceleration (seconds):** 0-60 m.p.h., 25.8; 40-60 m.p.h., 16.1; 50-70 m.p.h., 28.1.

Top speed:** 73 m.p.h.

*Includes federal excise tax, but no state or local taxes, transportation, or dealer preparation.

**Tests performed with Ongaro fifth wheel and fuel-flow meter.



A younger Dryden with a flying boat model.

The Man Who Put the Pace in Space

Dr. Hugh Dryden, NASA's Deputy Administrator, is an unusual man. He doesn't drink. Or smoke. When irked, he's likely to say, "Pshaw!"

But he's a skilled dealer with the Russians at Geneva, a deft executive, a thoughtful policy maker who has the ear of Congress and the White House.

Yet this gentle-voiced lay Methodist minister is first and foremost a scientist, a man who's been "in" on the government's space program from the start. Indeed, he helped shape it.

He knew it was the coming field when he graduated from Johns Hopkins in 1916 (after working his way through in three years). By 1919—and barely 21—he had a Ph.D. in math and physics, and a year later was director of the Bureau of Standards' aerodynamics lab.

His friends thought he was crazy. In the early Twenties there was little interest in airpower, and almost no money to spend on it. So when news came that General Electric had built giant 5,000-horsepower compressors for use in South African diamond mines, Dryden and several

[\[Continued on page 216\]](#)

After 45 years in "space," NASA's

WHY THE

By Joan Steen

IS PROJECT APOLLO—putting a man on the moon—a race? A crash program? Or a boondoggle? What's the truth about "spin-off"—are there really practical payoffs to the man on the street from all the space spending? What'll happen if the Russians do get to the moon first? And after the moon—what?

I jotted the questions down on my way to Washington to interview Dr. Hugh Dryden, the Deputy Administrator of the National Aeronautics and Space Administration. As the plane took off from New York's La Guardia Airport, I thumbed through newspaper clippings that either praised or damned the Apollo program. "Most scientists consider the proposed expenditures unjustified . . . and the frantic pace wasteful," said Warren Weaver, former president of the American Association for the Advancement of Science. . . . "Spending \$40 billion in a race for national prestige is nuts," said former President Eisenhower.

Equally vocal, but opposed, were Nobel Laureates Harold Urey, Willard Libby, Joshua Lederburg, and others who defended Apollo.

Who was right?

A few hours later I faced Dr. Dryden in his comfortable modern office in Federal Office Building 6—NASA Headquarters—a few blocks from the Capitol. On a nearby bookshelf stood a bronze bust of Robert Goddard, the father of rocketry, plus models of our Saturn, Titan, and Centaur boosters.

At 65, and with 45 years of government service behind him, Dr. Dryden is not a man to be flurried. He likes to begin at the beginning:

"Yes, Project Apollo is a race, but not just a race. It grew out of a series of meetings held after the 1960 presidential election, involving Vice-President Johnson, Mr. Webb [James E. Webb, NASA's chief], myself, and others such as General Bernard Schriever, of the Air Force, and Dr. Wernher von Braun. We met to discuss what America could do to be first, to be ahead of the Russians.

CONTINUED

Dr. Hugh L. Dryden fingers a model of the Orbiting Solar Observatory in his Washington office.

top scientist tells

MOON IS A MUST



PORTRAIT BY HARRIET ARNOLD

"Project Apollo is a race, but not just a race"

"With their booster, the 750,000-to-800,000-pound-thrust SS6, they could launch a large space station that could orbit the earth; they could circumnavigate the moon or even make a soft landing on it. We decided that our most dramatic next step would be to land a man on the moon. We'd have to build very much larger rockets for that, but so would the Russians. We'd be starting even with them—not four years behind.

"But to say that Project Apollo is a race doesn't do justice to its real significance. It's not that an American step foot on the moon first, but that we establish ourselves as leaders of a whole new technology that is essential for the strength and security of our nation."

"Many scientists and Congressmen agree with the aims of the space program, but say that we're trying to do too much too soon. They ask, 'Why don't we spend the money on curing cancer?'"

"Project Apollo's cost was put at a minimum of \$20 billion when it was conceived. That was three years ago. There were no complaints then. It's only now, when Congress has to provide the money, while faced with the forecast of a budget deficit, that the complaints are heard. We warned at the time—Don't start the program unless you mean to carry it through. Our original estimate set a target date for completion of the mission within the decade. It is not a crash program.

"As for the argument that the money could be spent on health or welfare, I recall discussing this with Maurice Stans, a former Director of the Bureau of the Budget. We agreed that even if the space budget were cut by \$100 million, not one nickel would be added to funds for cancer research or similar causes.

"We admit the budget is large. But you can set it in perspective in many ways. It's a space budget, but all the money is spent on earth—in factories, workshops, and laboratories. Over 90

percent of NASA's program is carried on outside NASA. The actual cost of Project Apollo comes to about \$25 a person for the next five or six years—less than what the country spends on chewing gum or cigarettes."

"How much of that cost per person will come back to us in 'spin-off'—new products or techniques that result from space research?"

"That's a problem no one can answer at this time. Certainly no one could say what the Wright brothers' invention would mean to the world. America didn't do anything much with it until after World War I. One of my first jobs with the Bureau of Standards was to make wind-tunnel tests of German airfoils; we had no U.S.-designed planes to test. We're more sophisticated now. At least we can talk about the potential of space: worldwide television broadcasts, enormous improvements in weather control (even a 10-percent improvement could save the farming and other seasonal industries hundreds of millions of dollars a year), cargo transport in a matter of minutes, networks of communication or navigational satellites . . .

"Historically, you can look at the automobile for a comparison. It's largely responsible for the development of alloy steels, new fuels, synthetic rubber, quick-drying finishes. . . . More subtly, its development brought us the concept of simplification for the operator through complication of design, a concept that has been applied to steel mills and oil refineries, as well as automatic washers and ovens.

"Yet none of these things fully describes the impact the automobile has had on us.

"So far, space research has led to high-temperature ceramics, ablating materials for heat protection, and pressure-stabilized lightweight tanks. It has also led to advances in electronics and to computers

[Continued on page 188]

Tiny Hillman has engine mounted in the rear

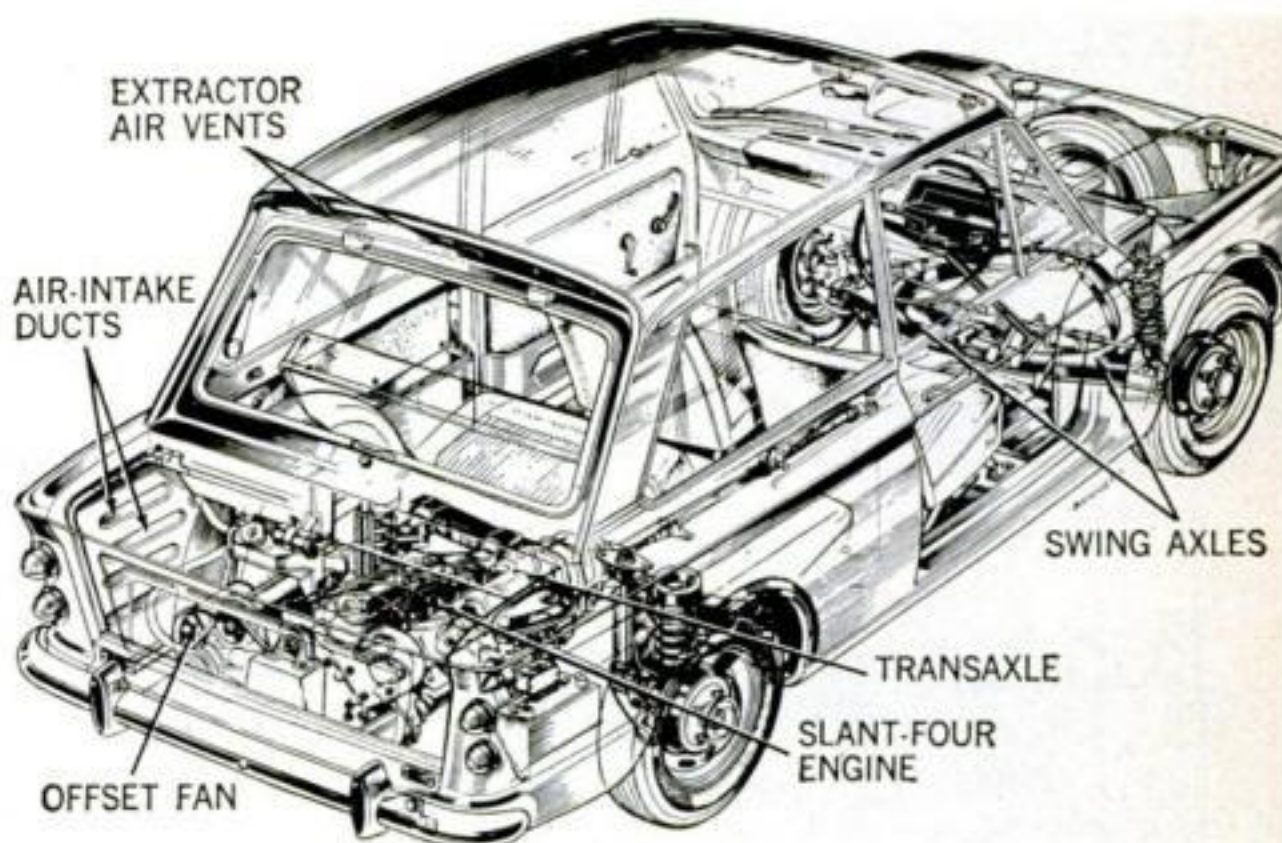
A new Hillman bristling with gimmicks is due here this fall. The British-made Imp, built in a new Rootes plant in Scotland, has a 53.4-inch aluminum rear engine with overhead cam.

The tiny in-line four is slanted 45 degrees, and is a unit with a fully synchronized four-speed transaxle. The engine weighs only 170 pounds, reducing the oversteer characteristic of many rear-engine cars. Its 42 hp. allows a 75-m.p.h. top speed.

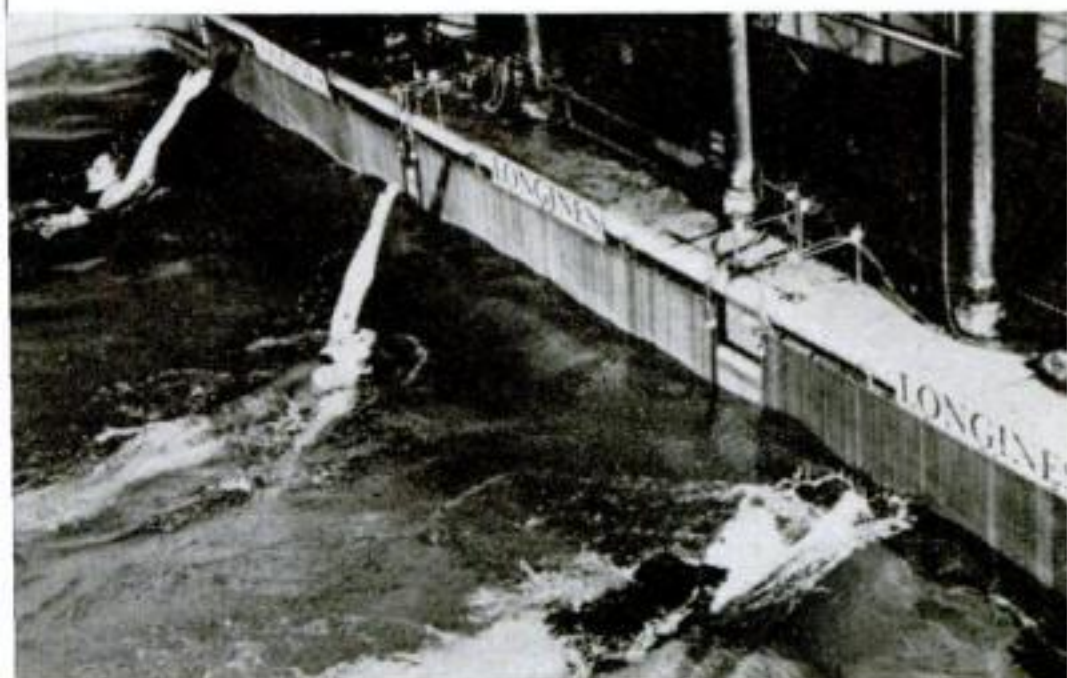
Throttle linkage is pneumatic; a tube connects an air diaphragm under the gas pedal to the carburetor, giving frictionless control. The car weighs 1,540 pounds and is 11½ feet long. U.S. price will be under \$1,500.



Hinged window gives access to luggage space over slanted engine. Rear seat folds forward for more room. There's a front trunk, too.

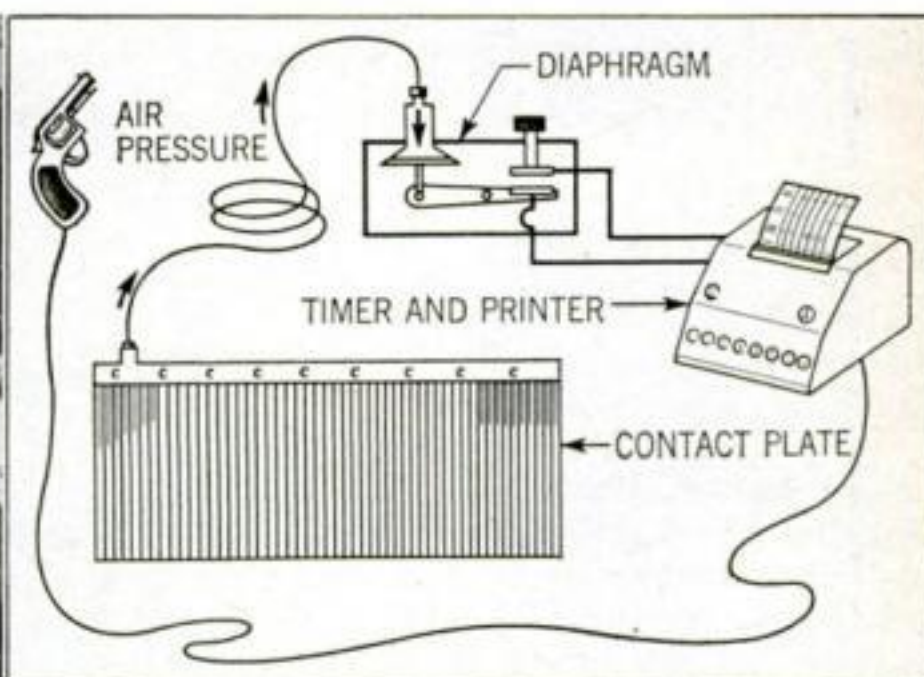


Coil-spring suspension is independent all around. Swing axles are used in front—both right and left axles swivel up and down.



Stopwatch prints swimmers' time

There's no dispute on who arrived first in races, with this Longines timer. As each swimmer reaches the end of his lane, he touches a contact plate, generating an im-



pulse in an air column leading to a printing unit. The diaphragm closes an electrical contact to activate the printer, which takes .035 seconds to record order of arrival and time. There's an equivalent delay in the starting gun, also wired to the timer.



Runway is 1,000 feet long, for home-based and visiting planes.



Two-way taxi-approach streets are named for famous flyers.



Ranch-style houses have plane ports as well as car shelters.

Newest suburb has carports for family planes

Buy a lot in a subdivision at Fresno, Calif., and you get a pilot's license thrown in. The development, Sierra Sky Park, includes a landing strip for private planes and 100-foot-wide streets — wide enough to taxi home from the airstrip. Most homes are built with two carports: one for the family car, one for the family plane.

A flight instructor during World War II and a real-estate man since, William V. Smilie acquired a 130-acre fig orchard and had it approved as a subdivision containing a landing strip. He has sold about half the 105 lots to retired flyers and beginners, and plans to put in a shopping center soon.

Smilie himself teaches buyers of lots to fly. If one already has a license, the instruction can be given to a member of his family. Smilie has hangar facilities and maintains five lightplanes for use by residents and other pupils. Two mechanics are on duty for service when it's required.

Weird craft used to photograph skiers

Here's how the press photographers at Cypress Gardens, Fla., get those close-up photos of fast-moving water skiers. The boat they use was designed for that purpose.

Added to the superstructure of the 44-foot Miss Cover Girl III to accommodate cameramen are a stern platform and a wide bridge—with an assistant standing at the opposite end for balance, to prevent capsizing.



WHAT kind of home shop would you like if you could have exactly what you wanted? We wondered, too, so we asked 10 of the country's top experts—all either editors or regular contributors to POPULAR SCIENCE—for their opinions on what the ideal home shop should be. You'll find their surprising answers—including many fresh and exciting concepts in planning and design—on the next 14 pages.

The Editors

PLUS:

● 6 pages of **BIG IDEAS** in home remodeling

● 5 pages about plastics, the **BIG IDEA** in home materials

25 pages of **BIG** **Ideas** for improving your shop and home

BIG Idea:

Multipurpose shop for a man with many interests



Luckett

TAKE three different kinds of shops, fit them carefully together like a dovetail joint, and the result is a multipurpose shop that makes each of the three more efficient and versatile than it would be alone. This is

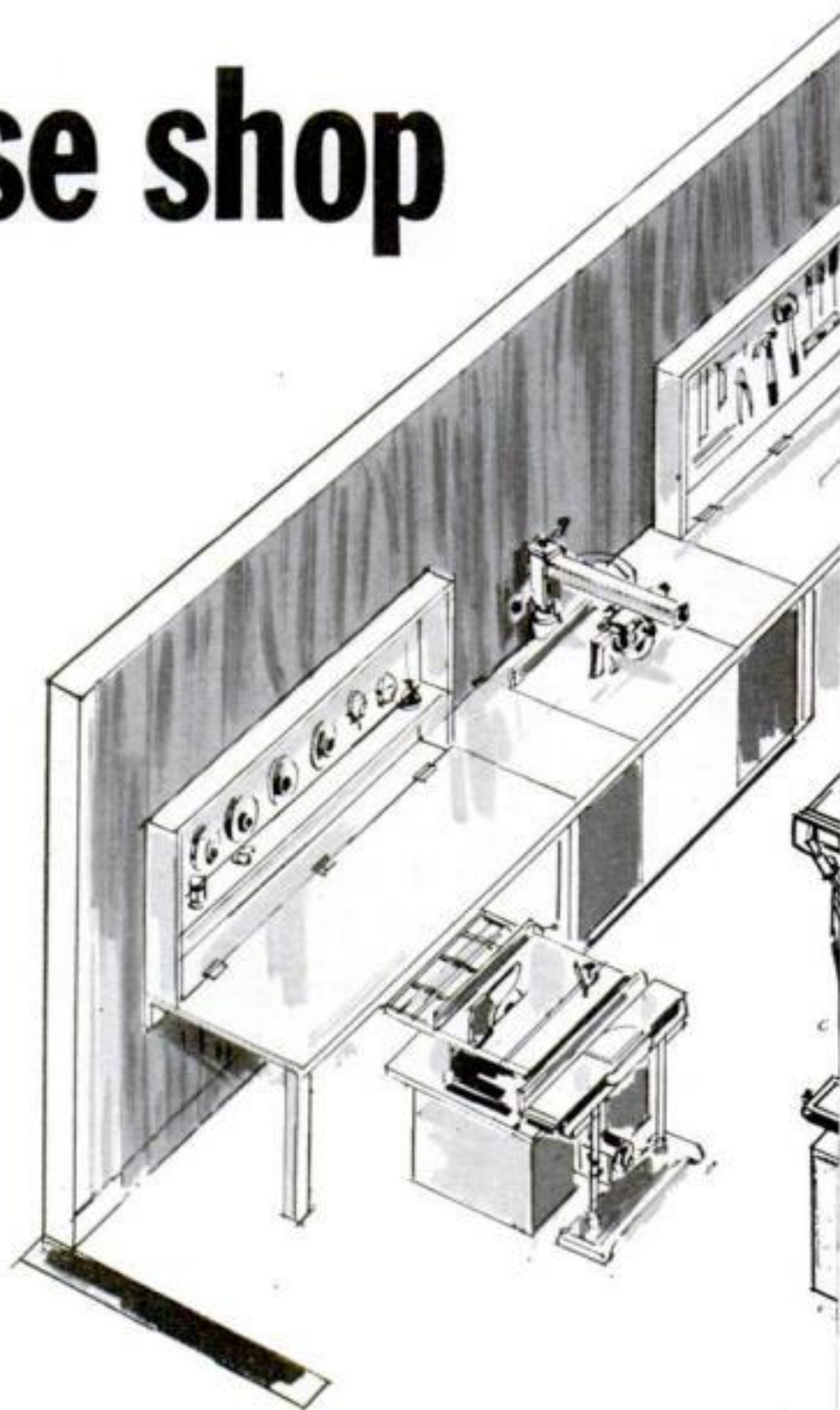
the big idea behind the unusual shop devised by Hubert Luckett, POPULAR SCIENCE's Technical and Electronics Editor. The shop is designed to fit in a two-car garage or equivalent space.

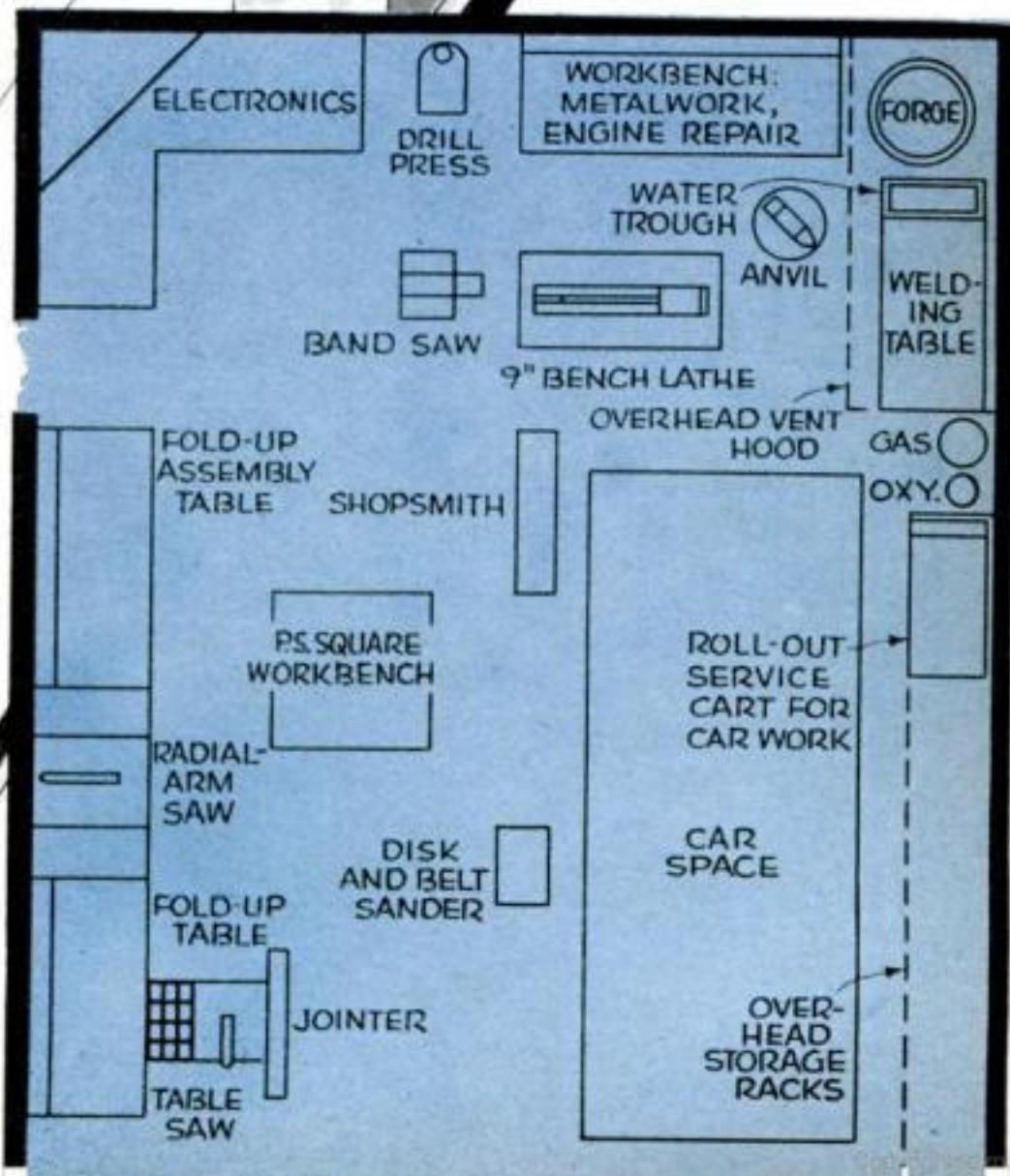
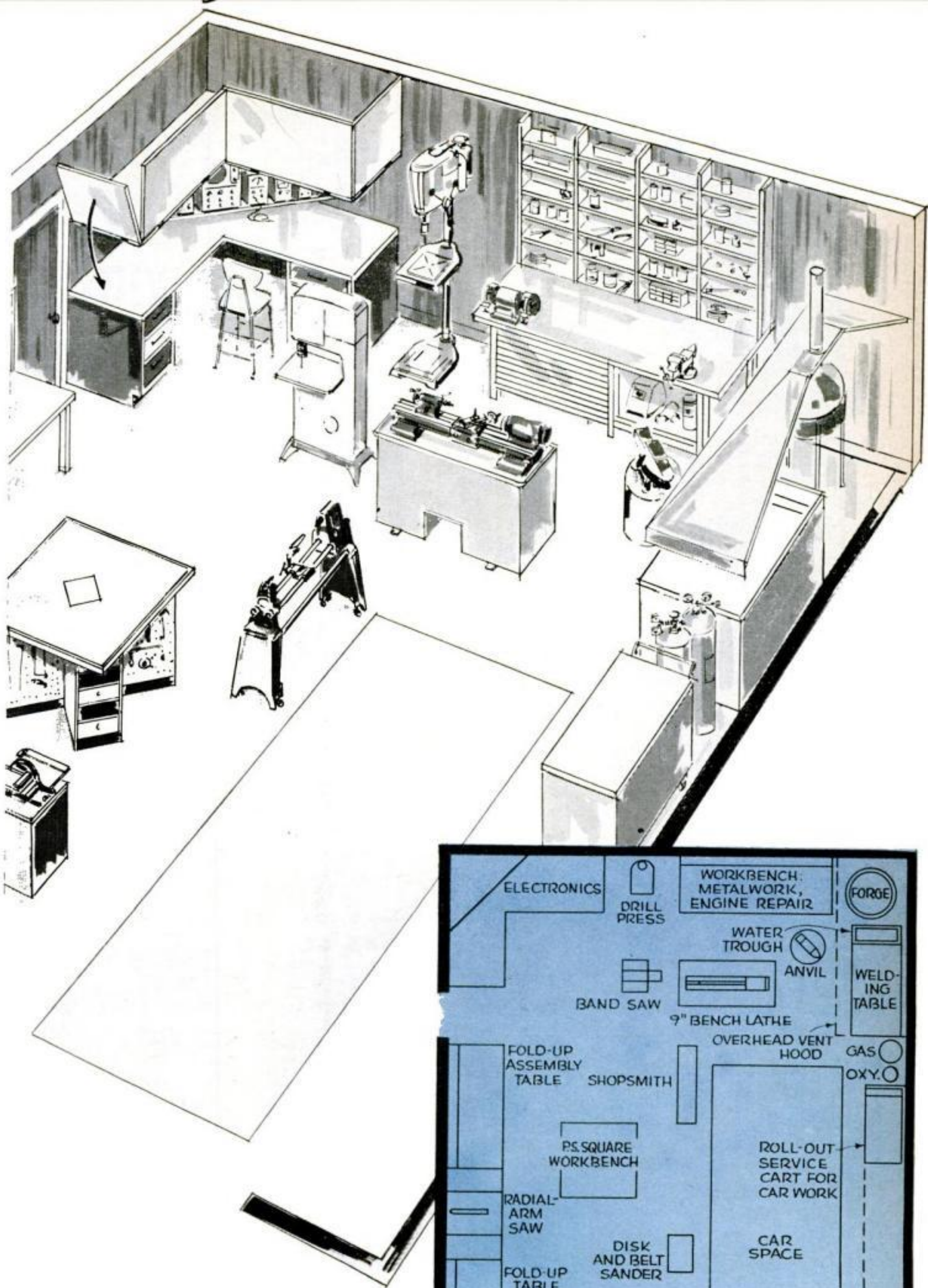
You'll find only four major power tools in the woodworking area. There's a reason for this. Note that the four—table saw, radial-arm saw, jointer, and belt-disk sander—are all used in the basic cutting and fitting of parts (for assembly on the nearby center-island bench). By organizing the primary work area around these four tools, you have a tight traffic pattern that saves steps. Tools used less frequently are kept out of this orbit so they don't get in the way. All benches and table tops are at the same height so you have ready-made outboard

supports for easy handling of large work.

Note how the radial saw and table saw are arranged at right angles so they complement each other's cutting functions. An extension table, hinged to the wall, folds down so it can serve both saws at the same time. An auxiliary fence on the extension can also serve either saw.

Small tools are stored on wall racks behind drop-down front panels. Swung down, the panels serve as work tables. Swung up, they become locked doors to keep tools





from straying. One rack next to the radial saw houses all accessories for both it and the table saw. A second rack on the other side of the radial saw houses hand tools.

The metalworking center. The drill press, bandsaw, and bench grinder are grouped with metalworking tools in the shop's second major work area. The reasoning here is that such tools are used as much or more for metalworking than for woodworking and are thus more conveniently located in the metalworking area.

Also included in the metalworking center are a 9" metal lathe, small forge, anvil, quench tub, gas and electric welders, and a welding table topped with $\frac{1}{2}$ " boiler plate. A hooded exhaust fan covers the forge and welding table to discharge fumes.

Tools and instruments for auto work are all contained in a roll-about cart. For his wood lathe, Luckett picked a multipurpose tool (Shopsmith) because it functions as a lathe and also offers the advantages of a movable headstock for horizontal drilling. "Although it's more expensive than a single-purpose lathe," says Luckett, "I find it worth the investment as a versatile problem-solver on difficult, offbeat woodworking jobs."

The electronic work center. The third shop-within-a-shop is in a rear corner of the garage. This consists of an L-shaped bench with test instruments on shelves running diagonally across the corner. An oscilloscope, the biggest instrument, is spotted at the center to take advantage of the corner's depth.

The corner location for the instruments makes them readily accessible for testing a chassis anywhere on either side of the bench. No matter how big the chassis, there is still an unobstructed view of the scope and meters. And you see them all at once—no looking back and forth from one end of the bench to the other, as often happens with the conventional straightaway layout.

A dropped ceiling over the bench houses fluorescent lights. Hinged panels fold down from this and completely enclose the work area. These keep out woodworking dust and allow you to leave half-finished projects out on the bench top without danger of their being disturbed.

Added touches: The complete shop is piped for compressed air. Overhead extension cords in retractable reels hang from the ceiling to feed free-standing power tools.

BIG Idea:

A welding center for casting, too



Walton

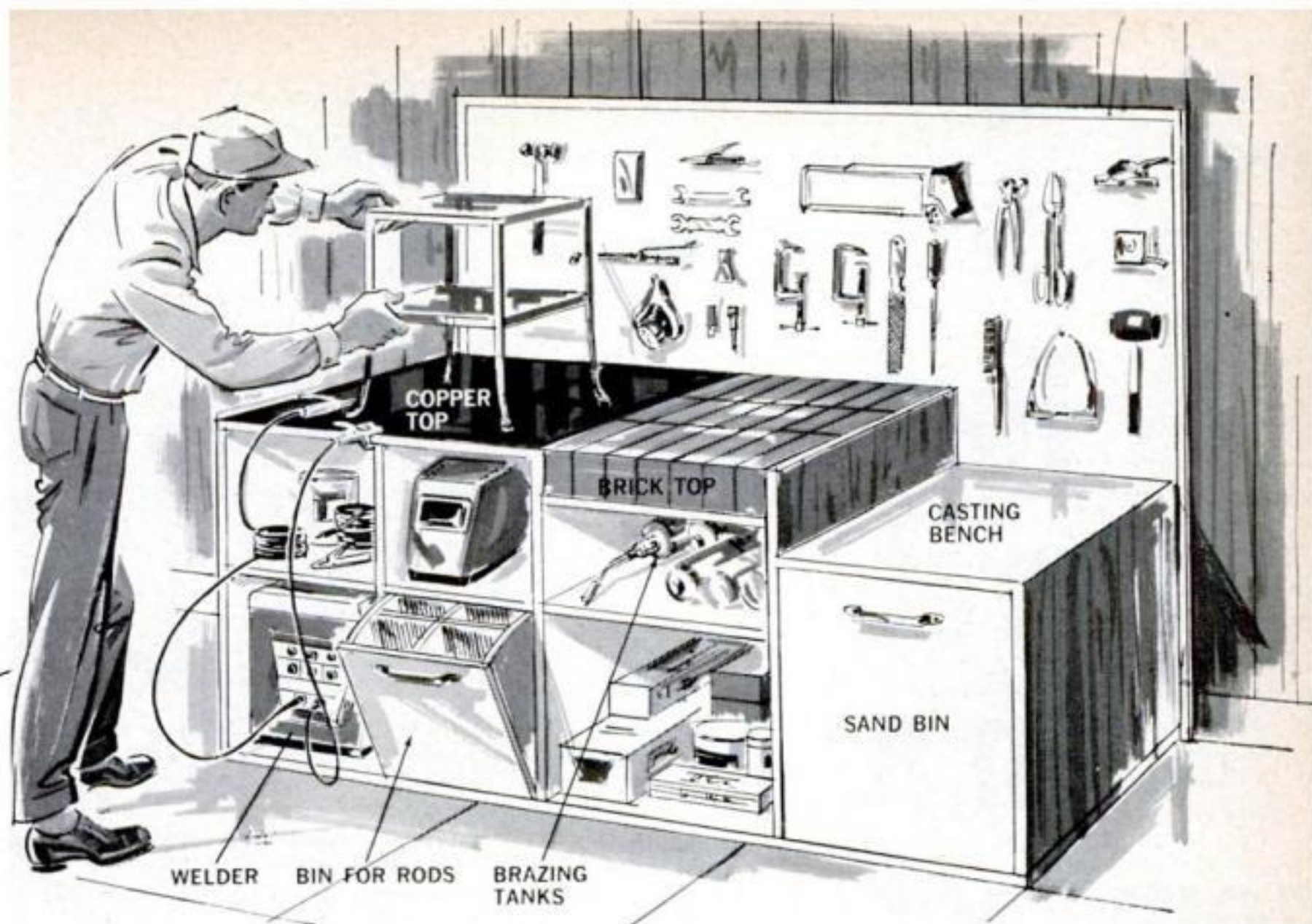
EVERYTHING you need for welding, brazing, and casting is at your fingertips in this compact split-level bench designed by Harry Walton, veteran shop writer and former Home Workshop Editor of POPULAR SCIENCE. The upper level provides both a brick-topped section for brazing and a copper overlay for welding. Welds don't stick to copper as they do to steel.

BIG Idea:



A spray booth

HOW would you like to spray gleaming finishes on projects right in your shop without the spatter and dangerous fumes that normally rule out indoor painting? The answer is an enclosed,



Casting is done on the stepped-down section at the side because you're either pouring metal or ramming sand into molds—jobs that aren't convenient at standard bench height. This area is topped with asbestos to protect against hot-metal spills. A small smelting furnace is set up on the bricked brazing shelf during casting.

The welder is housed under the bench along with masks, electrode holders, pro-

pane brazing tanks, and other supplies. Tilt-out bins hold sand for molding and assorted welding rods. Clamps and other tools store on the bench's backboard.

Because Walton's main interest is metal-working, there's also a 9" metal lathe, small Unimat jeweler's lathe, 12" drill press, power hacksaw, and grinder. Sheet metal is shaped in a bending brake and metal roll. Walton also insists on a spray booth.

filtered spray booth—one of the brightest new concepts in home-shop planning.

George Daniels, a frequent designer of projects for *POPULAR SCIENCE*, puts a home spray booth at the top of his list of most-wanted shop features. He also goes a step further. His spray booth doubles as a walk-in oven for quick heat-curing of glued projects.

Continuous-strip wiring throughout the entire shop lets you plug in power tools anywhere. Raceways run along the baseboard, along the front edges of benches, even along the ceiling. The ceiling outlets feed free-standing power tools and portable drop lights hung from hooks.

All hand tools store on open shelves instead of on wall racks. Says Daniels: "They're easier to

pick up and replace, and you don't waste time hunting for the exact spot to return each tool."

Daniels' workbench is a long 12-footer with removable vises so you can clear the top for large work. All major power tools are mounted on roll-about stands with retractable casters. There's a jigsaw, but it's set up mainly for power filing (a saber saw takes over most of the contour-sawing jobs that a jigsaw would normally do).

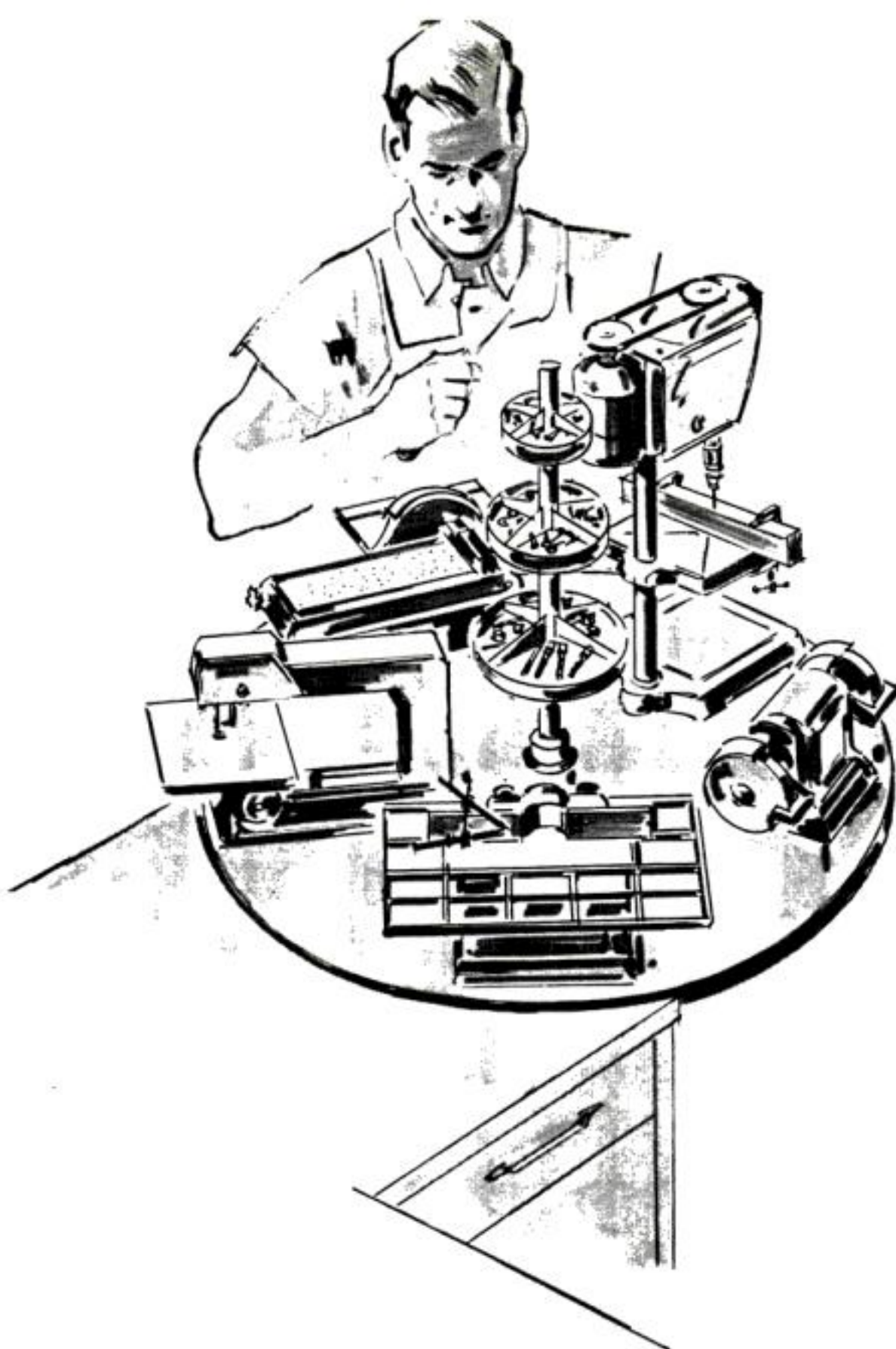
There are *two* drill presses—one for drilling and one for sanding drums, power rasps, and other accessories. "Saves a lot of time in changing setups," says Daniels. There are also two saber saws—a large one for heavy-duty work and a lightweight model for easy handling in cramped quarters.



Daniels

**BIG
Idea:**

Tool turret in a compact shop



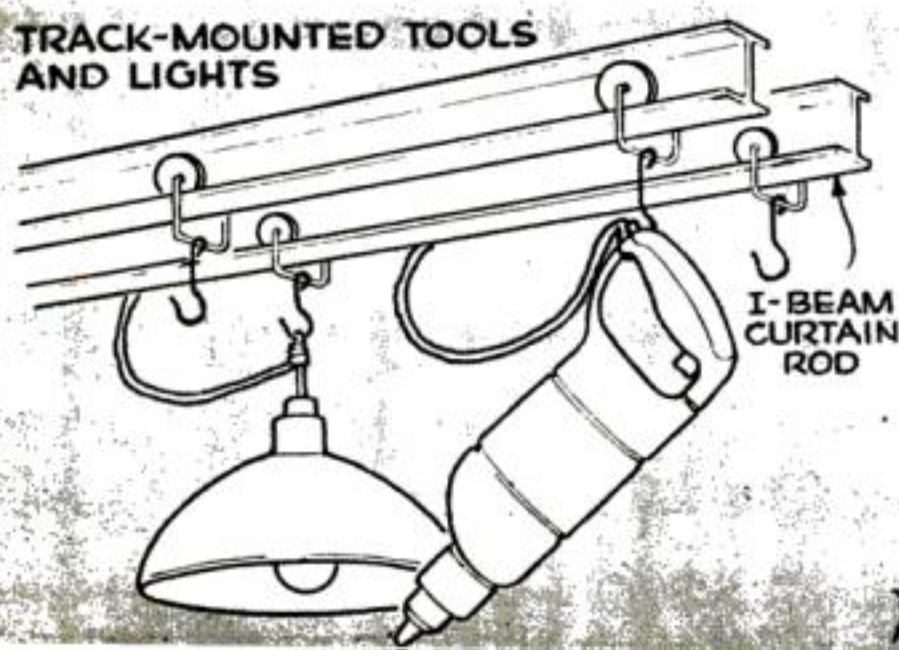
Gallager

A QUICK turn of this rotating turret puts any one of five major power tools right at your fingertips. The multitool turret—an idea borrowed from industry—is one of several unusual features you'll find in this shop designed by POPULAR SCIENCE Home Workshop Editor Sheldon M. Gallager.

The circular turret turns on a central pedestal of 3" pipe and holds a drill press, jigsaw, belt-disk sander, bench grinder, and small shaper. A spring-loaded latch locks the turret at any tool position.

Gallager's shop is designed with an eye to easy handling of large materials in a relatively small space. Lumber comes in through a drop-down, pass-through door and is fed directly onto a bench housing a

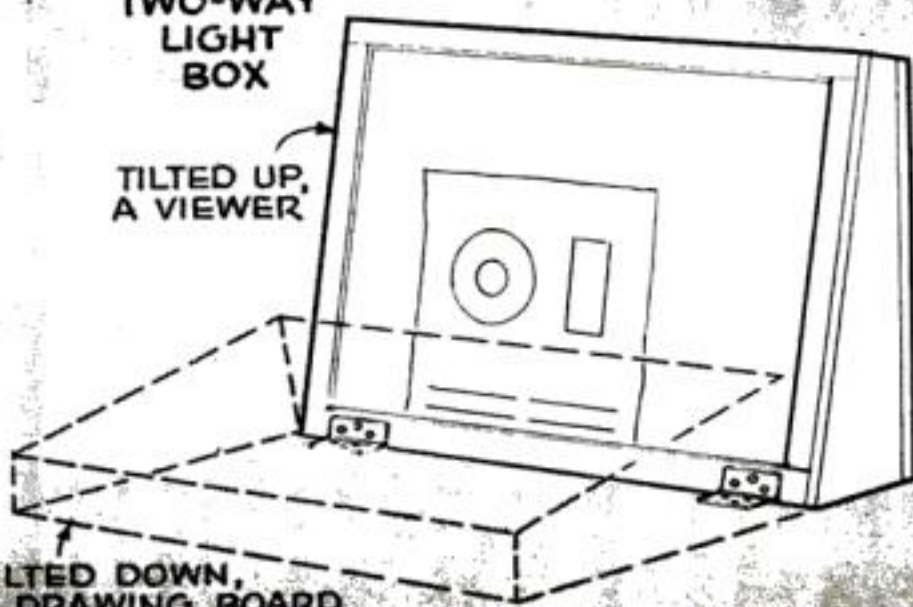
TRACK-MOUNTED TOOLS AND LIGHTS

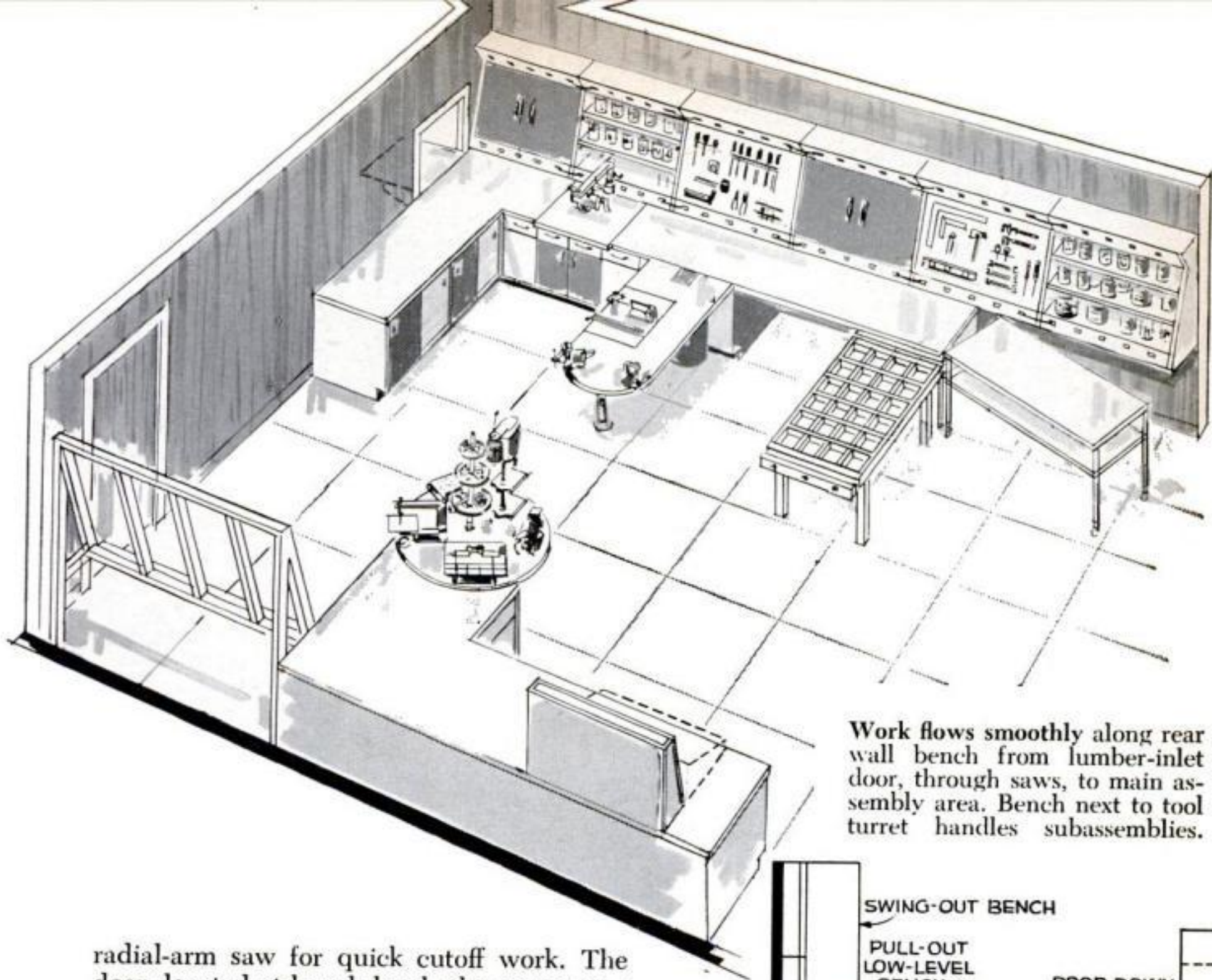


TWO-WAY LIGHT BOX

TILTED UP, A VIEWER

TILTED DOWN, A DRAWING BOARD





Work flows smoothly along rear wall bench from lumber-inlet door, through saws, to main assembly area. Bench next to tool turret handles subassemblies.

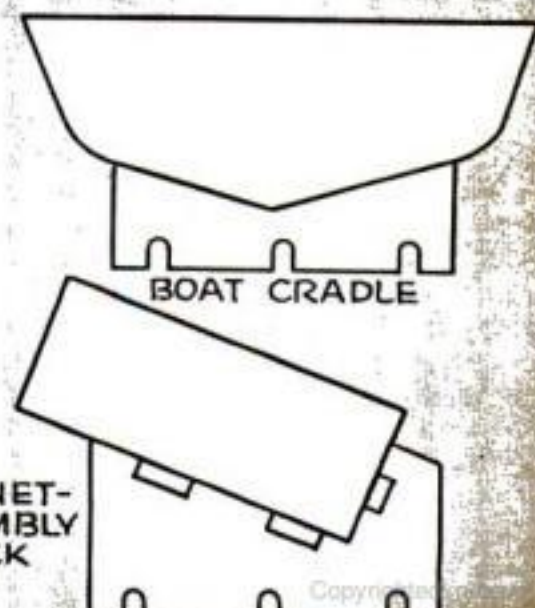
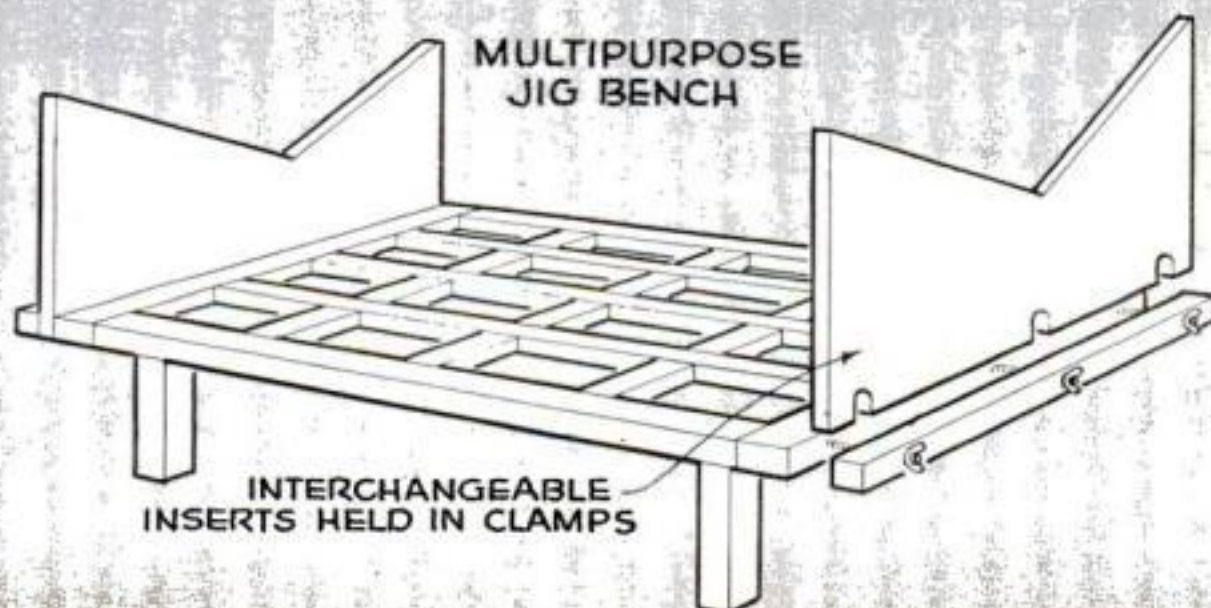
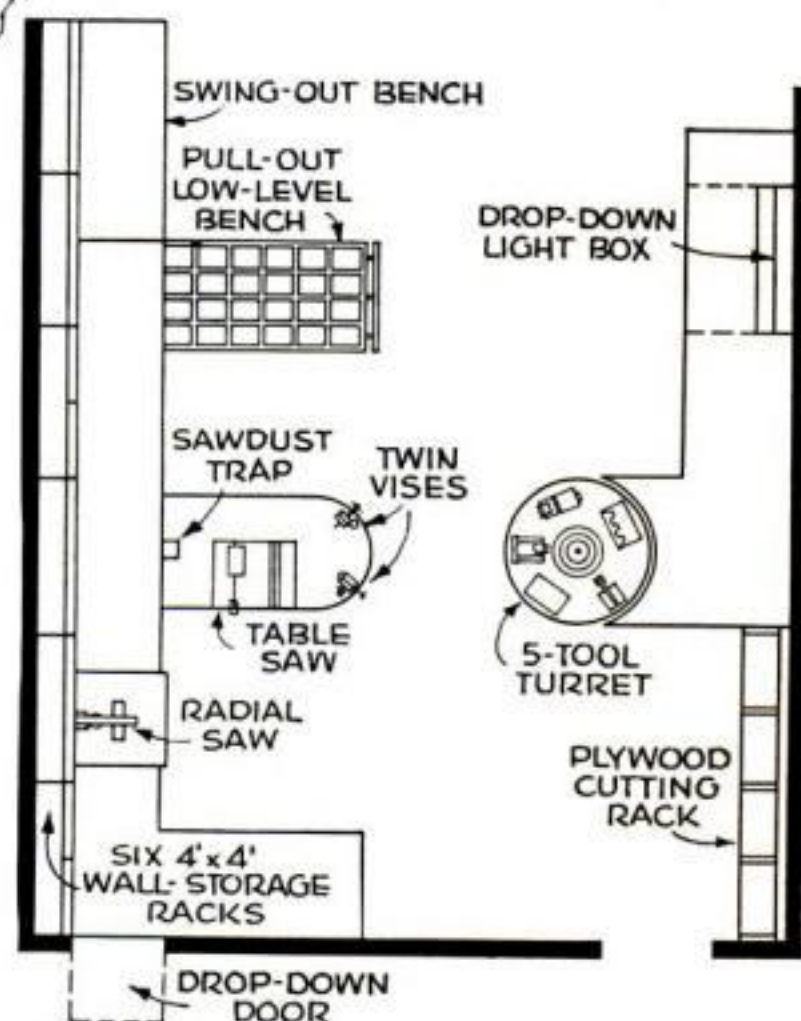
radial-arm saw for quick cutoff work. The door, located at bench level, also serves as a bench extension in its down position.

Large panels are stacked on a sloping, easel-like wall rack where they take little space. With a portable circular saw, you can rough-cut panels right on the rack. Guide strips can be clamped to the rack to support the saw and insure straight cuts.

"It's not as fancy as a track-mounted panel saw," says Gallagher, "but it works, and costs practically nothing to build." It also serves as a storage rack for partially cut panels. You just slice off a piece and leave the rest on the rack.

Opposite the tool turret is a semicircular peninsula bench with a table saw

CONTINUED



built into the top. The bench thus serves as both a work area and a giant saw table to support large stock. Twin vises are mounted on the bench's semicircular end.

"This arrangement is full of unexpected pleasures," says Gallagher. "You can work on all three sides of the peninsula, and move easily around the curved end because you don't bump into sharp corners. But the real joy is those twin vises. You can leave work set up in one while you switch to the other, or you can team them both up to hold long work or jigs."

A section of the wall bench swings out on casters to provide a second peninsula bench parallel to the table-saw bench. This serves as an outboard extension when you're running long stuff through the saw.

All wall storage is in the form of interchangeable 4'-square racks that simply sit on the benches. Some provide open shelves, some toolboards, some cupboards. The idea: You can arrange them any way you want and switch them as storage needs change.

Continuous-strip outlets run along both the top and bottom of each portable rack. Each strip plugs into the one next to it so you don't disrupt the wiring when you want to move a rack—you just unplug it.

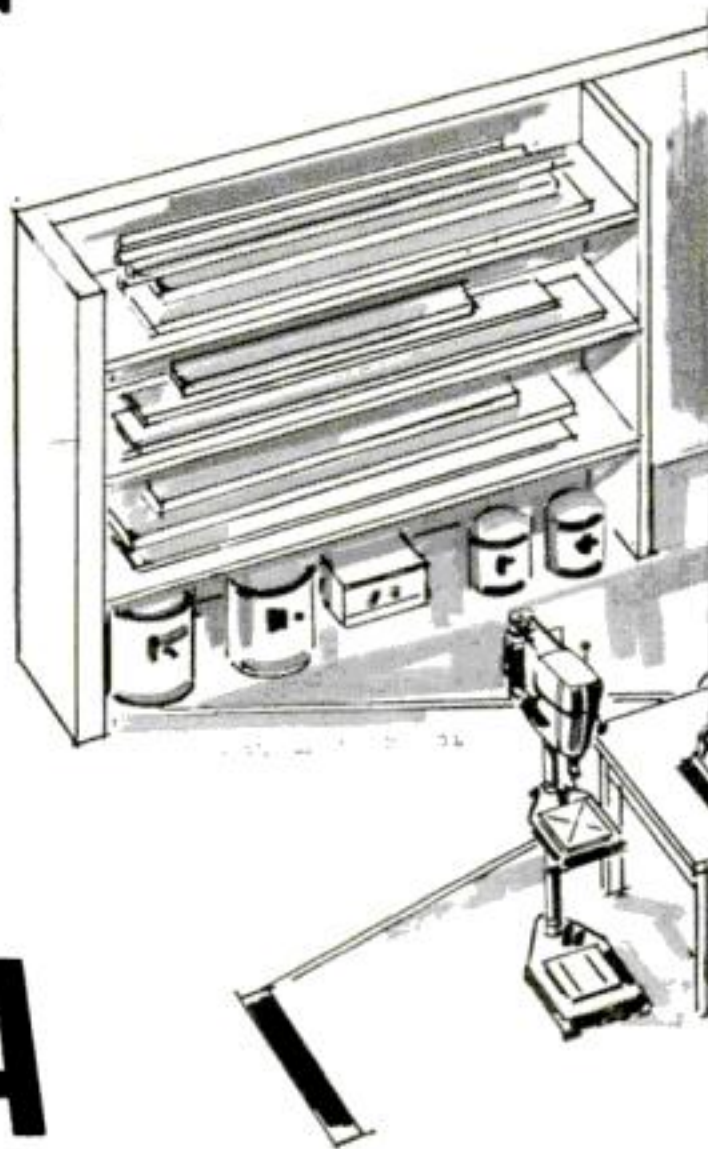
Drop lights and portable power tools, such as drills and grinders, hang from hooks over the benches, within easy reach. The hooks slide in overhead rails of I-beam curtain track so the tools and lights can be moved where you want them. Says Gallagher: "If you have to put tools back on a shelf, you usually don't—you leave them on the bench. But it's easy—and kinda fun—to rack them up on the hooks. And they're right there when you want them again."

The hanging tools and lights plug into the upper outlets so their cords are kept out of the way. Flat-base tools such as sanders and portable saws store on sloping wall racks and plug into the lower outlets.

A separate low-level table pulls out from under one wall bench for operations that require a kneel-on work surface. Its open grid construction lets you drill or saw right through it. Inserts can be clamped at the ends to form special-purpose jigs, such as a boat cradle or a rack for a kart chassis.

An unusual two-way light box tilts down to make an illuminated drawing board, and up to become a back-lighted rack for displaying drawings while you work. Fluorescent tubes inside shine either way through translucent plastic panels on both sides. ■ ■

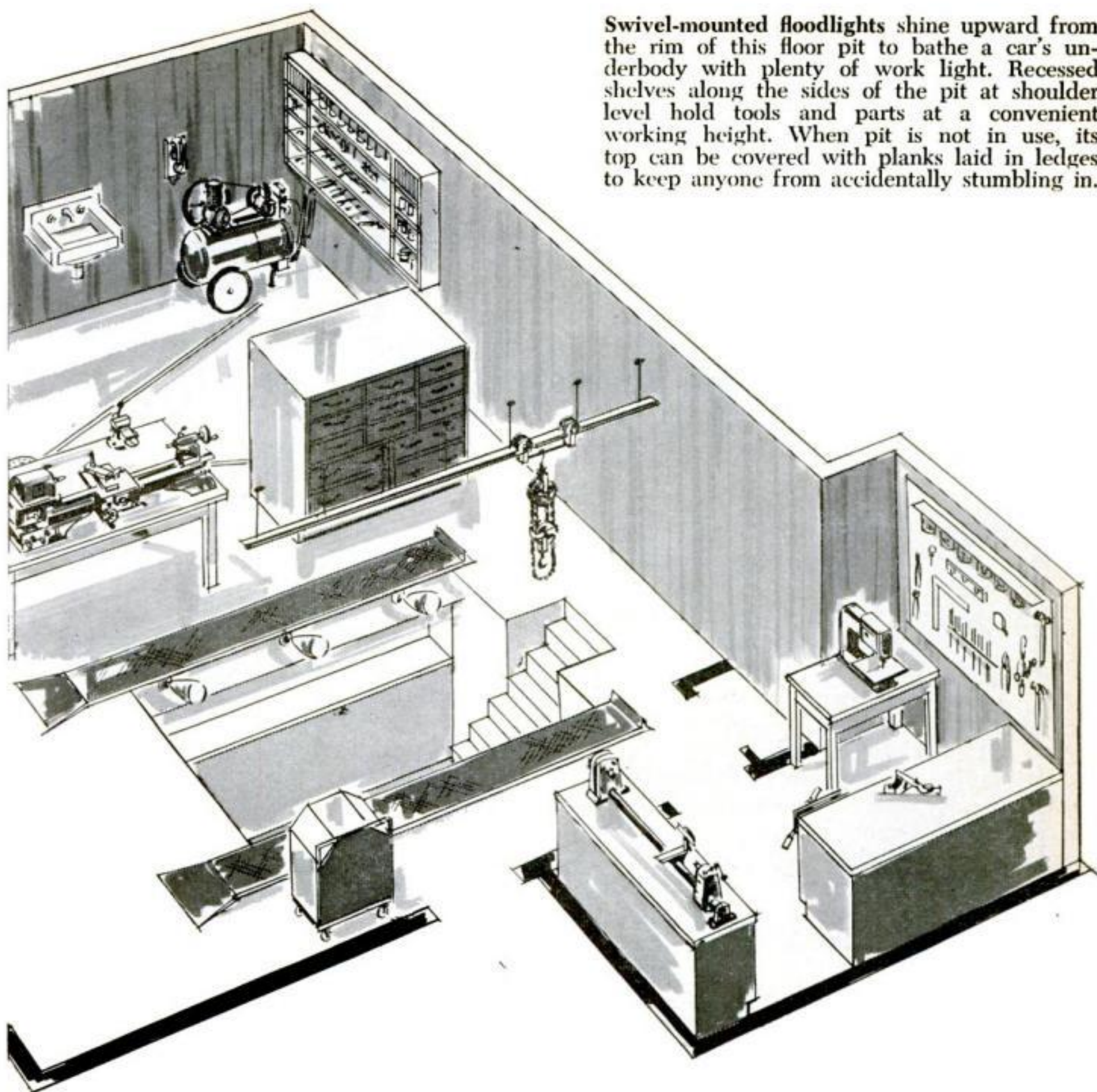
BIG Idea:



A pit shop for car repairs

IF YOU like to tinker with cars you have no doubt cast longing looks at your gas station's service pit and wished you could have such a luxury. Alex Markovich, who spends his days writing automotive stories for POPULAR SCIENCE and his weekends fiddling with high-powered cars, thinks the service pit is an important—and practical—part of any home shop devoted mainly to automotive work.

A costly dream? "Not at all," says Markovich. "You already have a garage. Putting in a pit is no more work than digging a small pool or a septic tank. It's just a hole



Swivel-mounted floodlights shine upward from the rim of this floor pit to bathe a car's underbody with plenty of work light. Recessed shelves along the sides of the pit at shoulder level hold tools and parts at a convenient working height. When pit is not in use, its top can be covered with planks laid in ledges to keep anyone from accidentally stumbling in.

about eyebrow deep lined with concrete blocks. You put as much effort into building a garden retaining wall without thinking twice."

Along the sides of Markovich's pit are recessed, shoulder-level shelves with lipped edges to hold tools and small parts. Centered over the pit is a traveling rail hoist to pluck an engine block off its mounts and handle other heavy gear.

On the other half of Markovich's two-car shop, the floor slopes toward a big center drain. "With this," he explains, "I can wash a car or flush out a radiator, and all the mess goes down the drain."



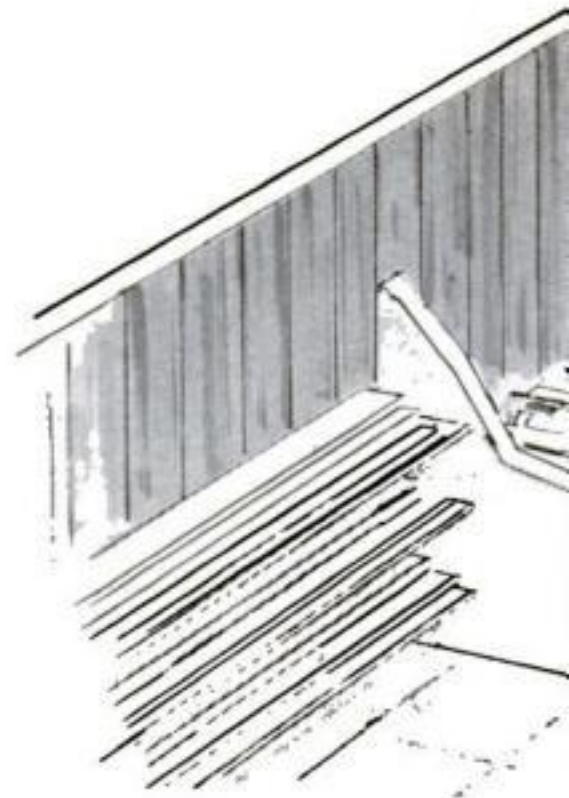
Markovich

In between the two work areas is a long bench with a metal lathe and power grinder mounted on it, a floor-model drill press, and a large cabinet with shallow drawers for portable power tools, hand tools, nuts and bolts, gauges, and other supplies. Wall shelves hold oilcans, paint, wax, cleaners, bulky items like welding equipment, and twin speakers for stereo hi-fi—Markovich likes to relax while he works.

Off to one side is a small, separate woodworking shop with a bench, bandsaw, and wood lathe. A mobile compressor in the main shop handles both power-greasing and paint-spraying equipment.

BIG Idea:

A rail hoist for heavy stuff



Lindsley
gear that such projects call for.

You don't have to have a big shop, however, to enjoy one convenience that Lindsley thinks is a must for any home shop—an overhead rail hoist. A luxury? "Not really," says Lindsley, "when you consider you can get a light-duty traveling hoist, like Sears', for as little as \$30."

Lindsley's shop is actually four separate shops arranged around a big central work area. At the rear is a quiet, walled-off planning center with a drawing board and file cabinets. Along one side is a repair center where the real greasy-handed work

is done on outboard motors, car engines, and the like. This includes metalworking tools and welding equipment. There's also a steam cleaner, wash tanks, a bearing press, a source of compressed air, and a spray booth. A branch-line rail hoist runs right into this room so that heavy gear can be rolled in and dropped on a bench.

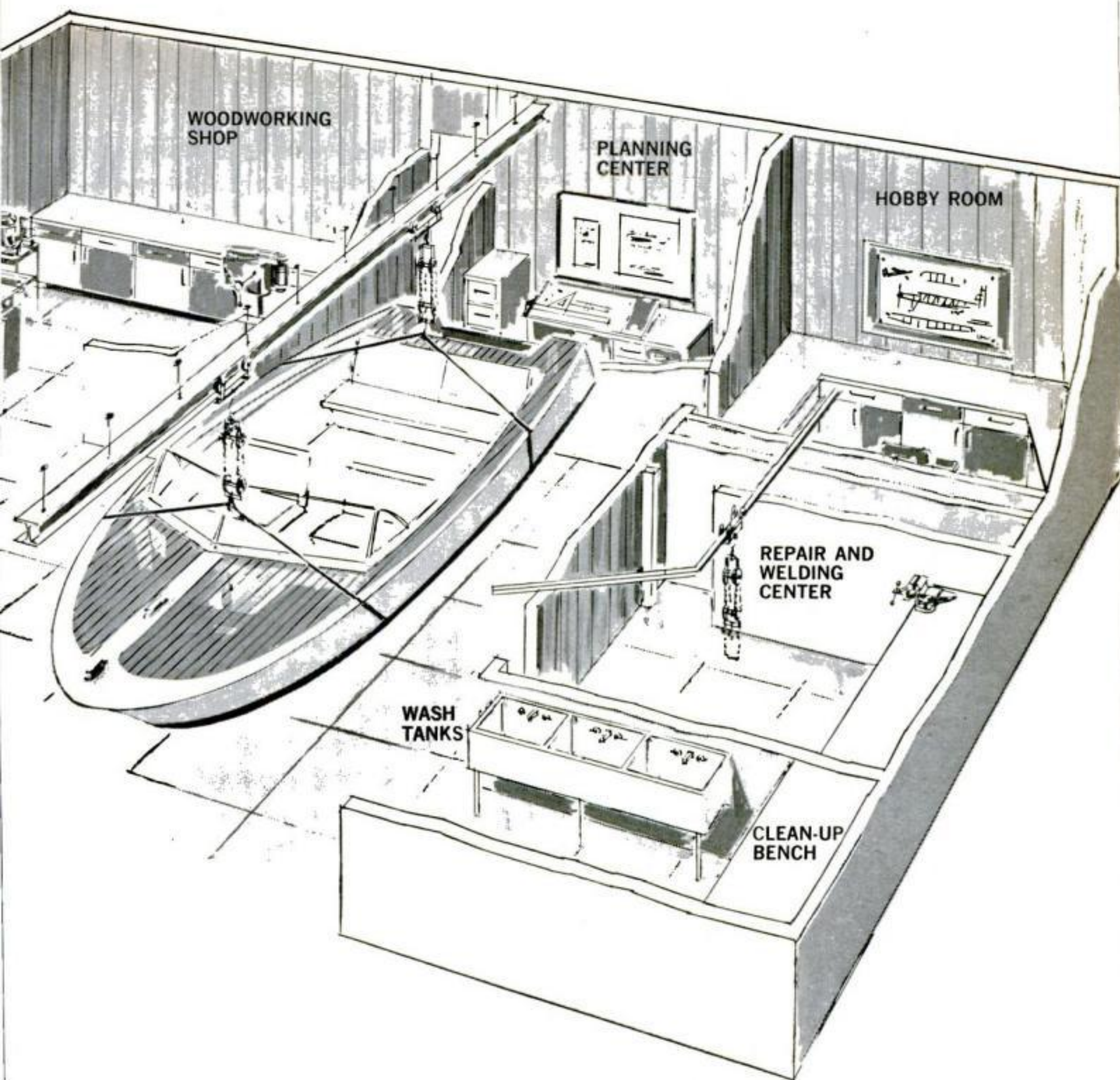
The woodworking shop is on the opposite side, well away from dirt and grease. The fourth shop is reserved for delicate electronic work, modelmaking, camera repair, and similar close-work chores. There's a large flat board for pinning down balsa sections, electronic test instruments, and small power tools such as a hand grinder and flexible-shaft drill.

One unusual tool that Lindsley insists on is a heavy-duty sewing machine. "It's great for sewing car or furniture upholstery, making a sail, or even fabricking an airplane," he says.



BIG Idea: A separate building

THE perfect shop is a separate building away from the house, where screeching power saws, welding pyrotechnics, and sawdust-tracking aren't a family problem. So says Henry Comstock,



well-known free-lance writer and former **POPULAR SCIENCE** staff member.

"It's off in the back yard—the way garages used to be. In fact, a two-car garage with big doors facing the driveway is just right. This way, you work in private, have no tool-rusting problems as you do in a cellar, and can go off and leave delicate setups without their being disturbed."

Comstock, who is also an artist, applies the artist's use of north light to shopwork. Big windows across the entire north wall let in

even, glareless illumination. The floor is wood construction topped with vinyl to provide a surface that's both easy on your feet and easy to keep clean. An independent power line brings in both 110-volt and 220-volt current.

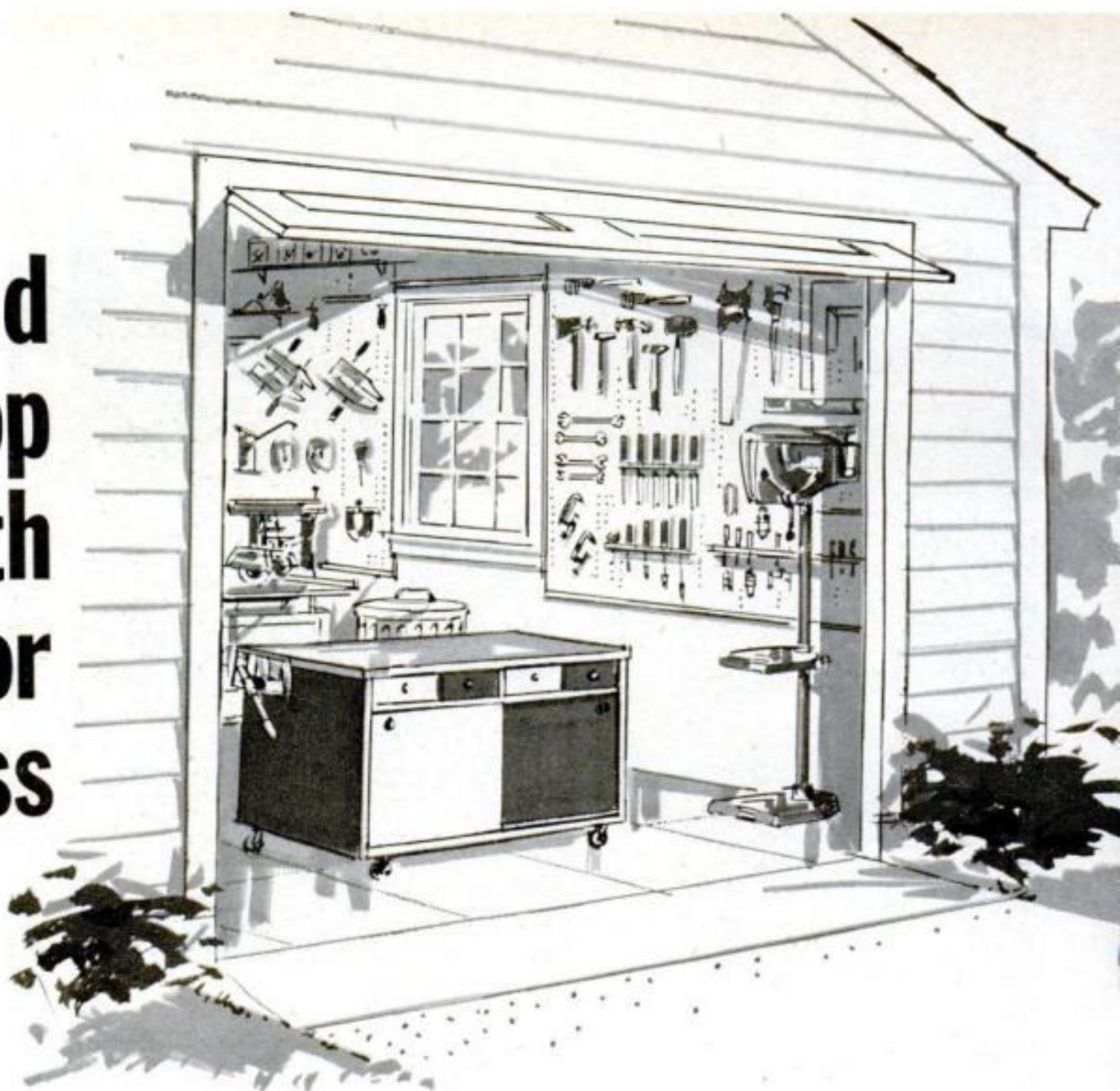


Comstock

A few feet out from the windowed north wall is a long free-standing bench that can be reached from all sides. Overhead hooks hold tools and chain hoists for handling heavy work. Major power tools are mounted on retractable casters so they can be rolled about.

**BIG
Idea:**

Island shop with big-door access



A WALK-AROUND workbench gives you the most elbow room in the least space, thinks R. J. De Cristoforo, author of books on power tools and a frequent contributor to *POPULAR SCIENCE*. Add a big garage-type door and you have an island shop with almost unlimited freedom in handling large stock and cumbersome projects.

De Cristoforo's shop is designed to fit in a garage, preferably of two-car size, although the same principles can be applied effectively in a one-car space. The island bench, about 4' square, is mounted on retractable casters so it can be rolled to one side, or even outdoors, when extra floor space is needed.

Lining the walls around the bench are power tools on individual roll-around bases. These are moved out from the walls as needed to provide work space around them.

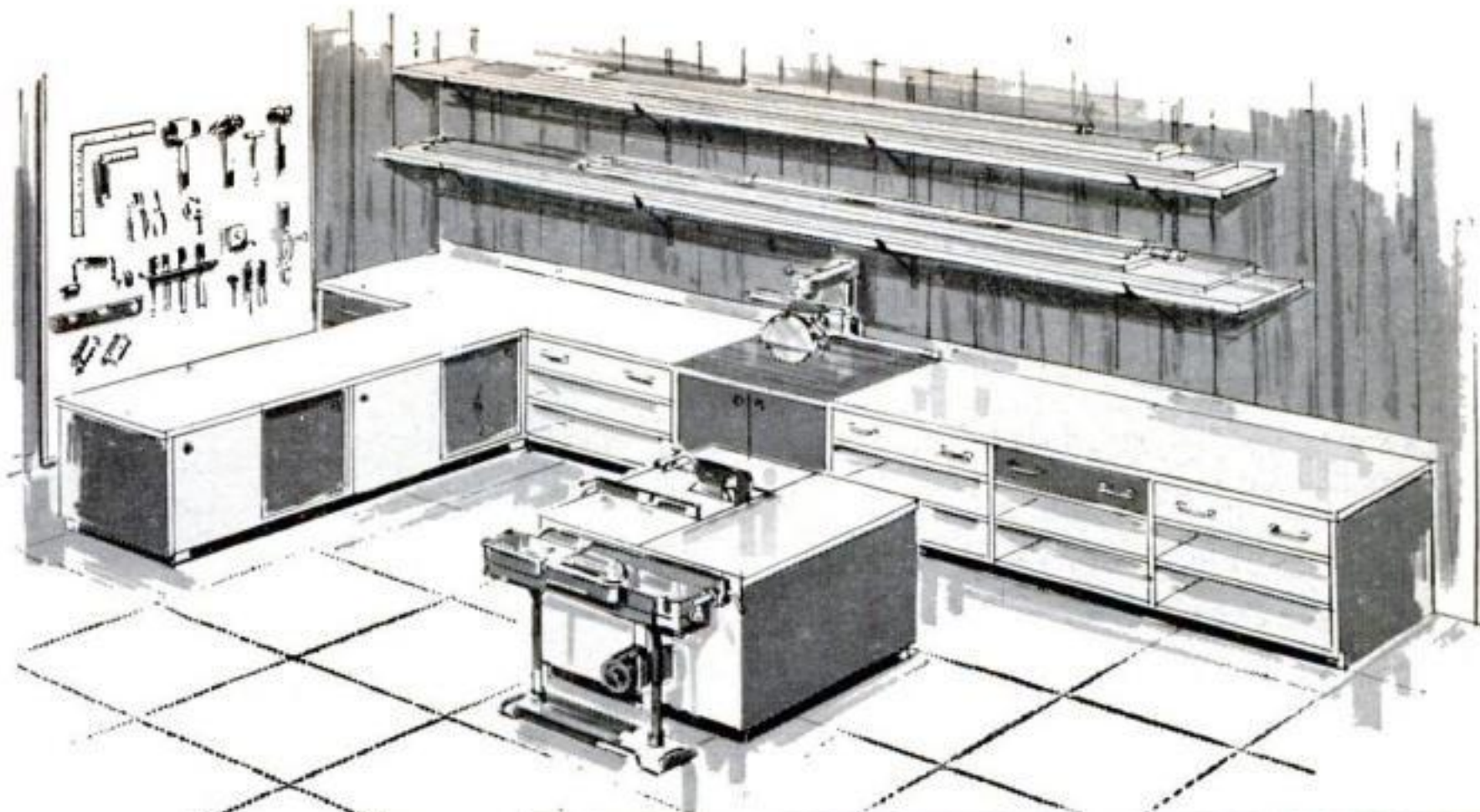
How are the tools powered? "From outlets flush-mounted in the floor," says De Cristoforo. "The outlets are spaced every few feet so you can plug a tool in anywhere without trailing cords all over the shop."



De Cristoforo

Small hand tools, accessories, and supplies are stored in shallow wall cabinets arranged to provide individual "work stations" for particular jobs—one for electrical work, one for arts and crafts, one for hand woodworking operations, and so forth. The cabinets have drop-down fronts that serve as work tables when lowered, doors when raised. The backs of the cabinets are perforated hardboard spaced $\frac{1}{2}$ " away from the wall so you can insert tool hangers, shelf brackets, and other ready-made fixtures.

De Cristoforo splurges on one thing: He has twin radial-arm saws set up side by side to handle a variety of jobs without having to switch blades.



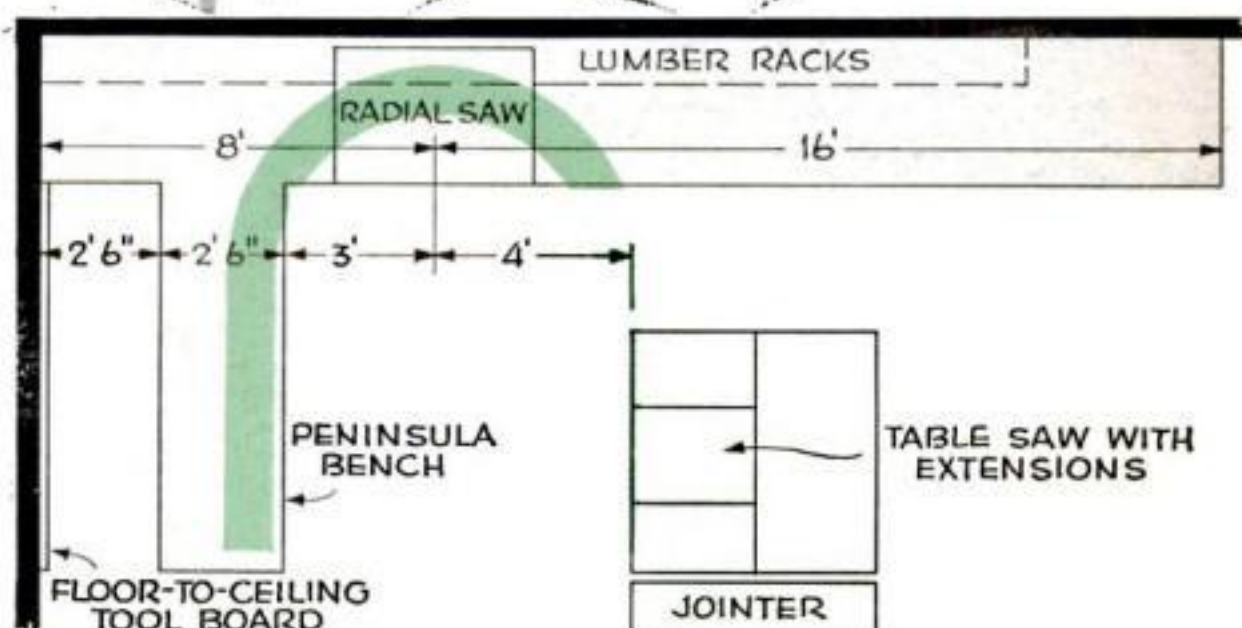
**BIG
Idea:**

U-shaped shop for saving steps

YOU'RE never more than a step or two away from any tool or work area in this compact horseshoe-shaped shop. It was devised by Jackson Hand, a professional designer and nationally known shop expert. While Hand's shop is considerably larger to handle his professional work, the woodworking part shown here is designed to fit in a small basement or single-car garage.



Hand



"The beauty of this plan," he points out, "is that it not only saves space, but is actually the most efficient way to work—everything is within easy reach."

The horseshoe shape is formed by a radial-arm saw built into a wall bench, a peninsula bench that extends out from this at right angles, and a combination table saw and jointer that completes the other side of the horseshoe. You do your cutting on the saws, then simply swing around to face the peninsula bench for assembly work.

The radial saw is mounted in the wall bench 8' from one end and 16' from the other. There are important reasons for these dimensions. They let you cut 16-footers at the middle or the ends. Eight-footers can be worked from either side of the saw, depending on which is more convenient.

Immediately over the radial saw are long wall racks for storing lumber. "You just pull a piece off the

CONTINUED

rack, drop it onto the saw bed, and slice it up," says Hand. "There's no need to horse long stuff all over the shop."

The radial saw and table saw team up in a number of useful ways. "For example," he says, "with a molder head on the radial saw and the table saw set up to rip, you can turn out molding by the yard as you need it, cheaper than you can buy it and faster than you can go and get it."

Both saws and the peninsula bench are at the same height so each serves as an out-board support for the others to handle large work. The table saw is located at the shop's midpoint; this leaves 12' of clearance both in front and in back of it for maneuvering long work. Oversize table extensions support big panels.

Just behind the peninsula bench is a full floor-to-ceiling tool board. "This is the most efficient way of storing hand tools that I've found," says Hand. "You can walk right up and reach them easily with no bench in the way to make you stretch. And the big full-height board holds a lot of tools in one spot so they're not spread all over the place."

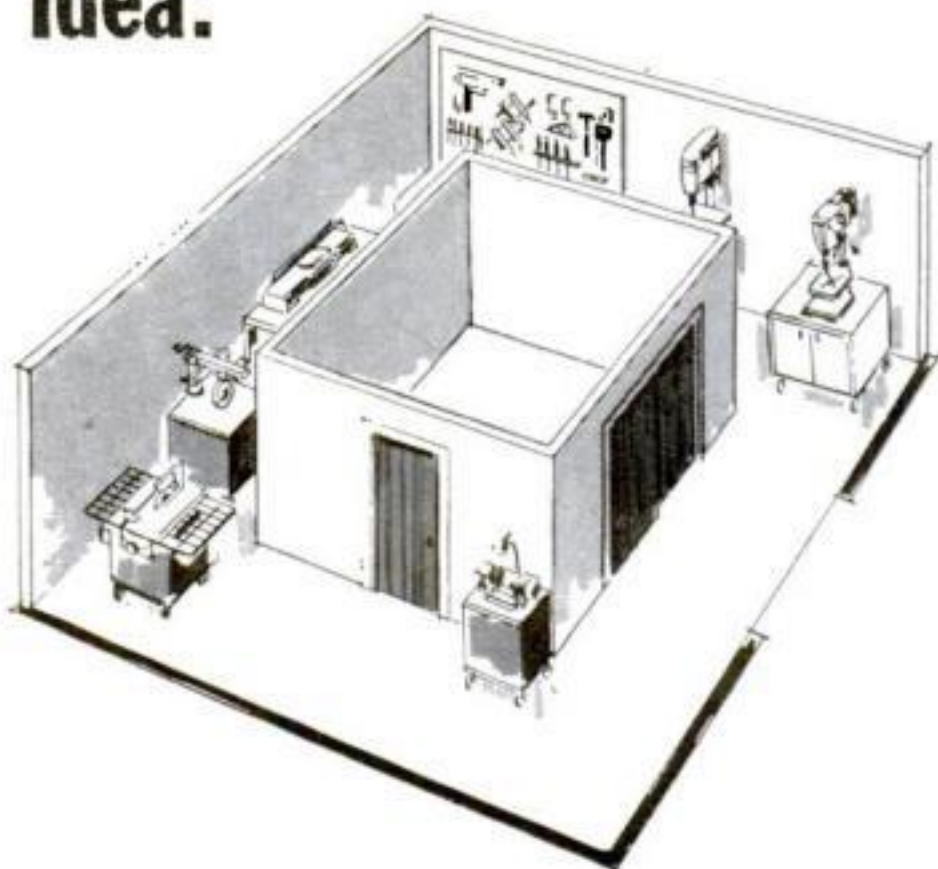
The jointer is a big 6" model, not so much for its cutting width but because a machine this size has a good long bed for accurate jointing. The two saws have identical arbors—an important point in choosing a team of tools. The reason: Blades, dado cutters, molding heads, sanding plates, and other accessories can be mounted interchangeably on either saw.

Hand also makes a point of specifying a wood lathe: "When you need a lathe, you need a lathe. Unlike other power tools, there just isn't anything else that can take its place." Hand's lathe is mounted on a movable base and is set up on the radial-saw bench when it's in use.

Other tools in the shop are a drill press, bandsaw, jigsaw, shaper, and bench sander. These are all caster-mounted and can be rolled out into the main work area as needed. A shop doesn't have to be big, Hand believes, so long as you can move tools about to take advantage of available work space.

One luxury Hand allows himself is a pair of electric drills. "Say you're drilling screw-holes. It's a big help to have one drill fitted with the pilot bit and the other with the clearance bit. Or you can keep a sanding disk in one and still have the other free for drilling."

BIG Idea:



An empty room



Burroughs

A CLEAN, concrete-floored, white-painted, well-lighted empty room—that's John Burroughs' prescription for the ideal shop. "There wouldn't be a tool in it," says Burroughs, a professional designer and

long-time contributor to POPULAR SCIENCE.

Surrounding the empty room in storage corridors would be a full complement of power tools on casters, a mobile welding rig, a drawing board, sawhorses, a roll-around workbench, and several wheeled tool caddies—all capable of being moved quickly into the empty room as needed. The idea: You bring only those tools you want for a particular job into the room. When you're finished, you roll them back into the storage corridors and wheel out new tools for the next job.

This way, uncneeded tools never get in the way of those being worked on, and you make maximum use of available work space. At the end of a job, cleanup's a snap—you have nothing but a bare room.

BIG Idea shops

how they add up

EXCITING things are happening to home shops. The old concepts are gone. The ideas on the preceding pages prove it. Today's shop is an efficient, power-equipped work center, a basic home need.

To be sure, some of these ideas take space. Some take money. But mostly what they represent is a quality of imagination—a special spark of ingenuity—that can be applied to any shop, big or small.

Note how many of the ideas are actually simple in concept. Having all your work surfaces at the same height. Putting tools on casters so they move. Organizing your jobs around central work areas.

Note the surprises, too. A garage door in your shop? A spray booth? A rail hoist? Duplicate tools for convenience? Overhead outlets? A pit to get under your car? Why not these? They're good sense and not as much of a luxury as you might think.

But in the end, it's the clever planning, the unusual benches and built-ins, the special jigs and fixtures—these are what make a shop a place where you really want to spend your leisure hours.

POPULAR SCIENCE believes that the home shop is about to take giant strides toward a new and important place in modern living. The ideas here are presented as evidence that a shop can be more than just a place to work. More important, it can be a place of inspiration and fun.—*The Editors.*

BIG Idea: Live in the whole attic

By Harry M. King



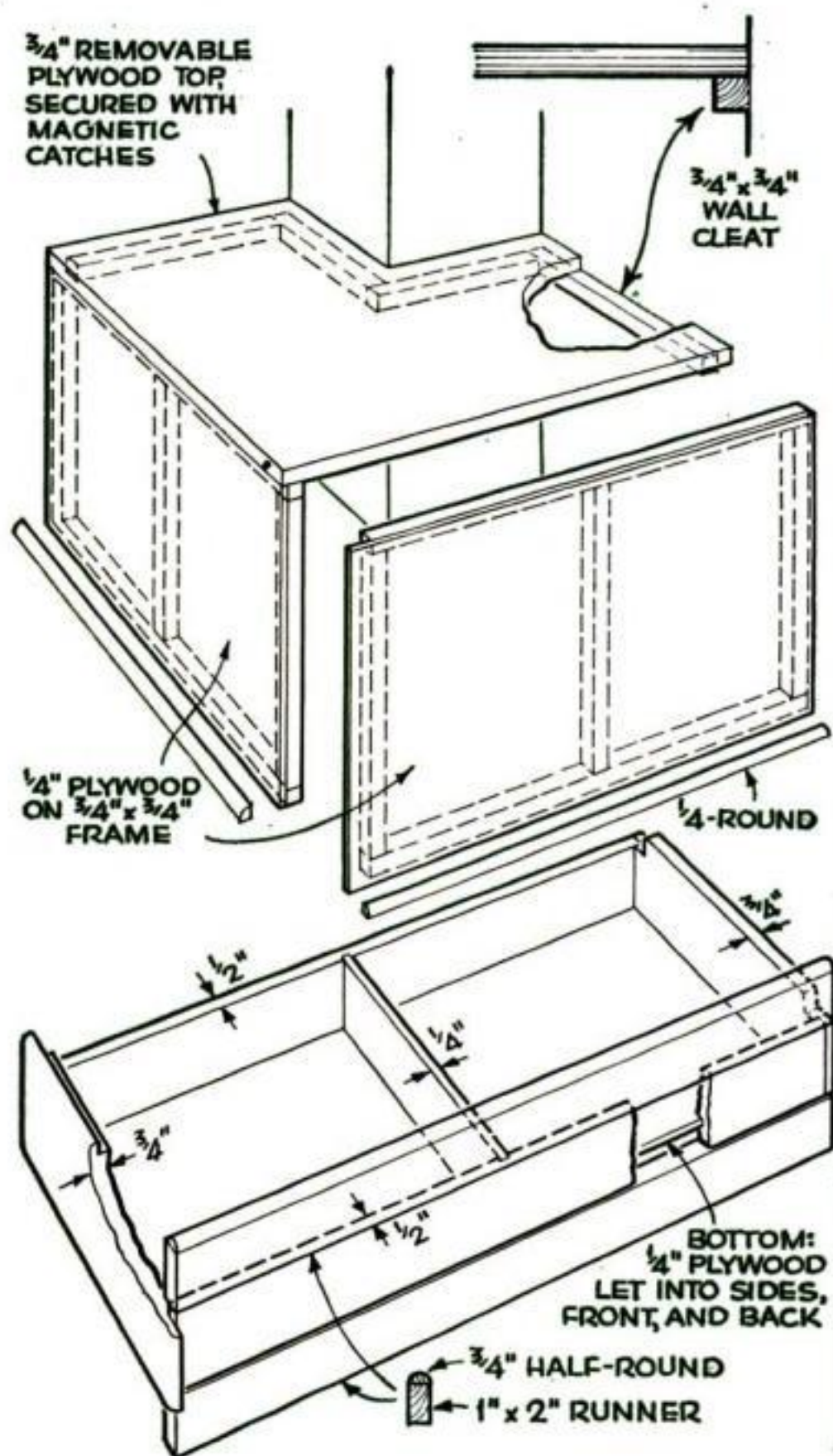
Double the living area in your attic by putting to work the dead space behind knee walls. Cut it away and slip in a single bed. Corner storage unit combines to make a perfect bed table. Or frame out wall for drawers and shelves (right). Desk was built at same time as wall units, features same drawer construction, has vinyl top.

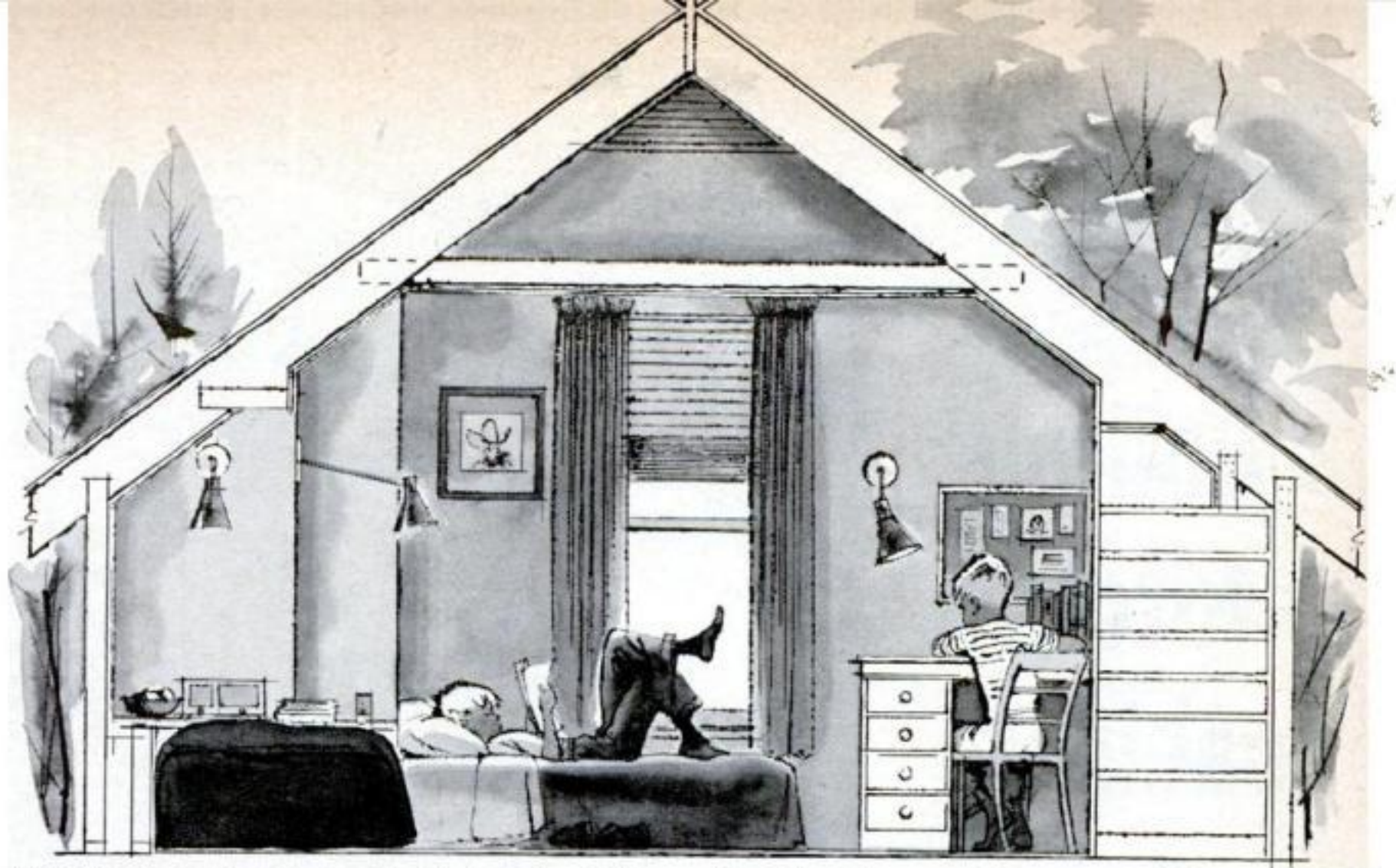
YOU may be overlooking a gold mine of usable space in your attic. Where? Behind the knee walls. Sure, you'll bang your head if you try to stand up there, but a drawer can't get hurt. Fact is, you can build a whole roomful of drawers, shelves, and bed space into the knee wall, and still have cubic footage left under the eaves for general storage.

Save yourself money and effort installing the drawers by following the simplified framing method shown at right. There are two secrets to its smooth operation: Allow $1/16''$ to $1/8''$ clearance between the top of each drawer and the bottom of the guide above it, and apply drawer wax to the runners. The runners are easily made by topping each side rail with half-round molding to make a smooth-sliding guide. Use hardwood for the runners.

As you can see, this "free" attic space can also be made into a sleeping alcove. You'll gain precious floor space by doing it. Then add a spare-blanket cabinet in the corner (sketch at right) and you'll get the advantage of more storage.

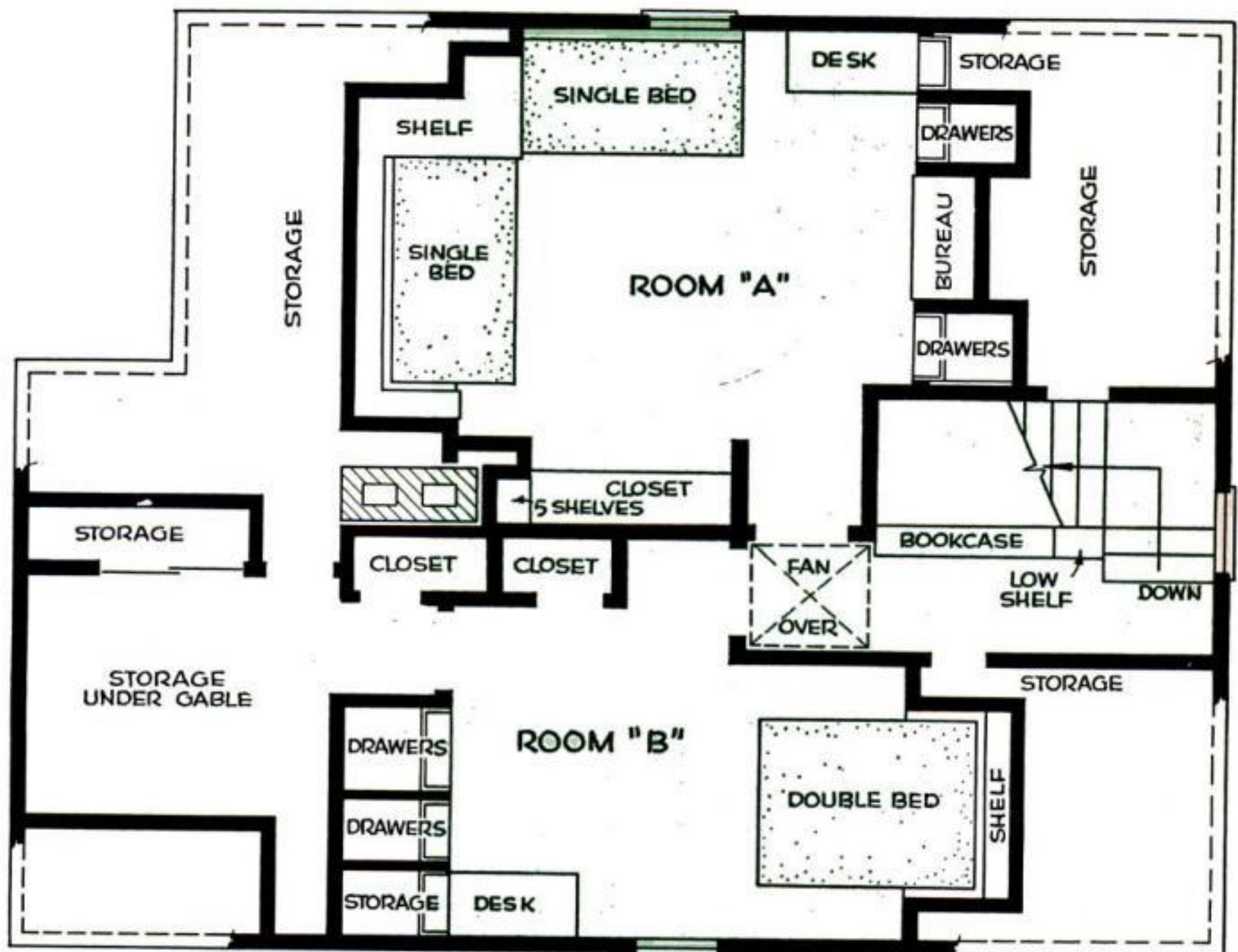
When you break through the knee wall, it's a good idea to rebrace the rafters with a header, so the ceiling won't sag. Two two-by-sixes on end should do the trick.





Gained space shows up clearly in plan below and sketch above. Tinted area on plan represents original floor space in attic. Can you imagine how it would look if all the under-eave drawers were bureaus; all the insets for beds closed up? Try sketching it out on the plan, and see how

fast that floor area is eaten up. When you finish the attic, remember to insulate above ceiling, along rafters over room, and behind knee walls not used for drawers. Include vapor barrier, too. Note on plan access doors that enable you to get to under-eave general storage space.



**BIG
Idea:**

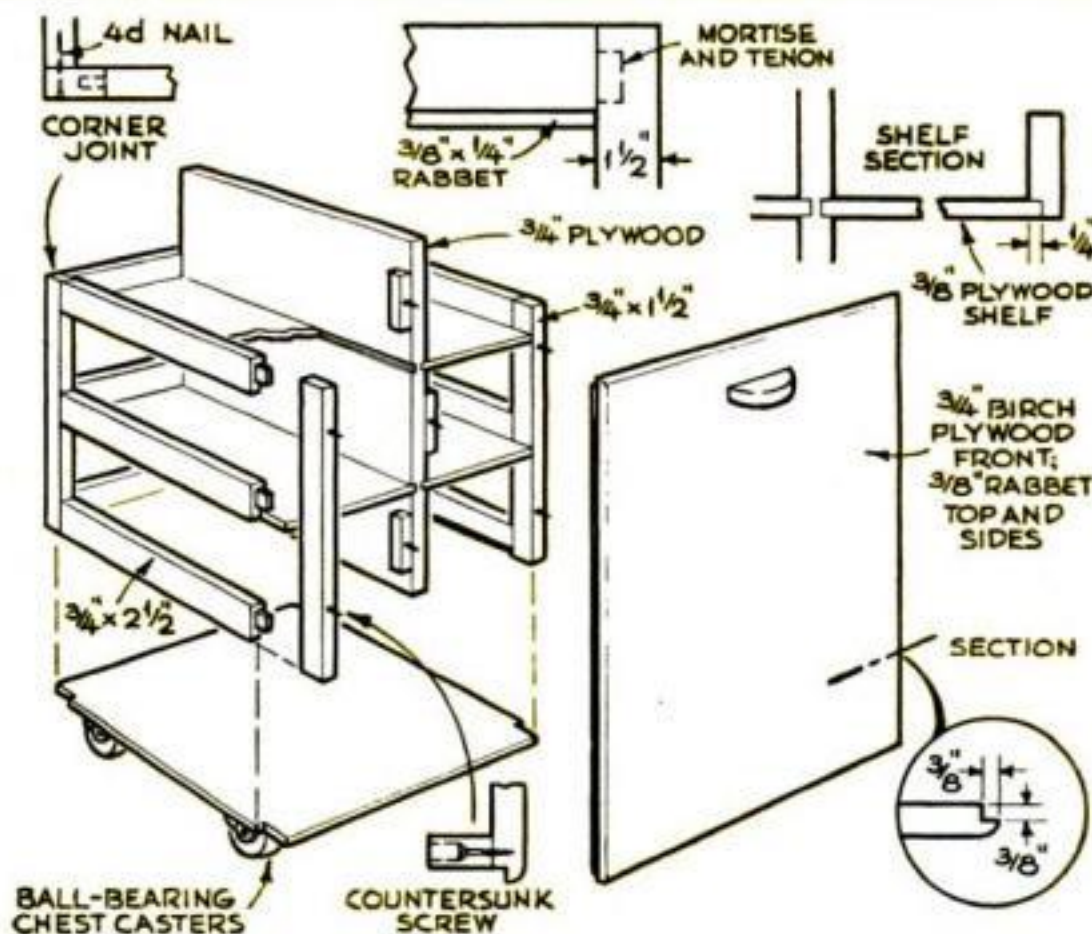
Roll-out kitchen cabinets

THESE roll-away undercounter cabinets are mighty practical. They save steps and time in setting the table and make storage more convenient.

They're adaptable, too. In this kitchen, they fit a 22" counter opening. If your kitchen space is limited, just shrink the dimensions. For example, build *one* roll-away cabinet 18" wide, with china shelves on one side and glassware dividers on the other. (In any case, make the divider holes to fit your own set of glasses.)

Since the cabinet is going to get shoved around, it pays to make the joints tight. This means mortise-and-tenon joints for outer framing members, deeply countersunk screws to hold the $\frac{3}{4}$ " plywood panel in front, and glue at all connecting surfaces. Follow through by using hardwood for the framing members.

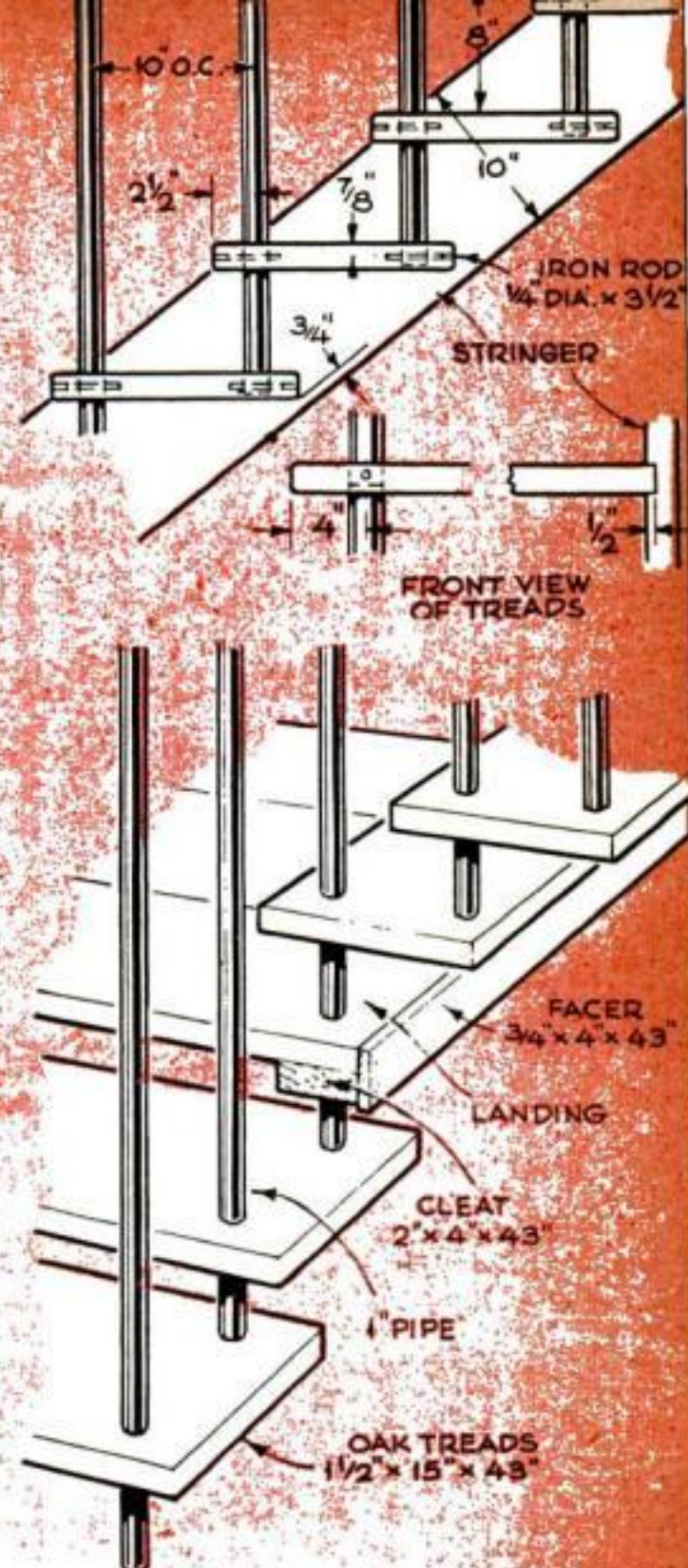
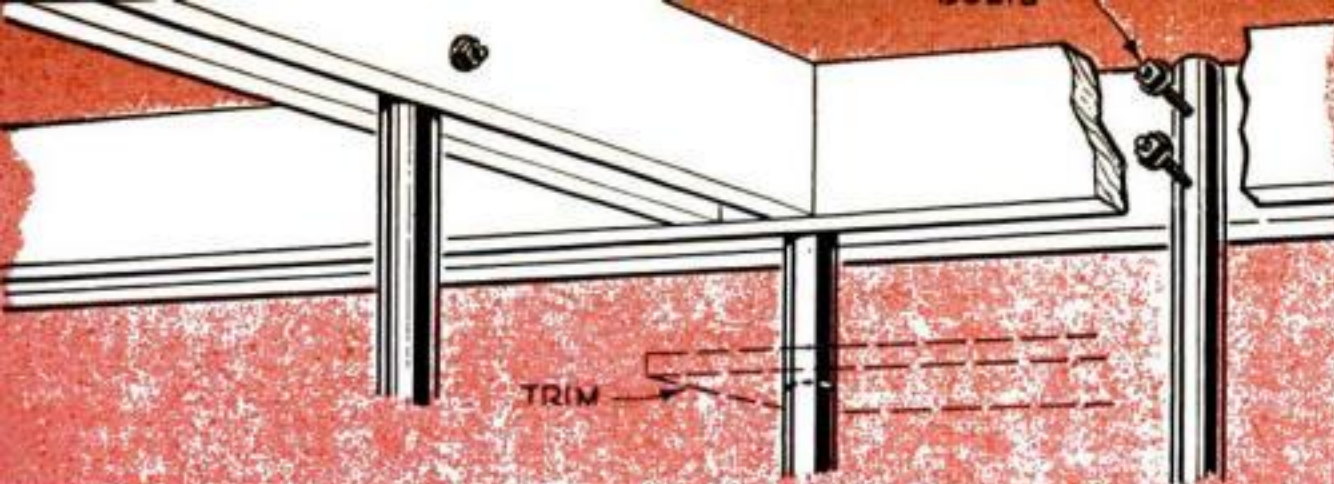
Since the interior of the counter will be in plain view when the cabinet's rolled out, you'll want to finish it. Easiest way is to panel with $\frac{1}{4}$ " plywood to match the exterior. (And don't forget to extend the floor covering under the area.) A $\frac{1}{2}$ "-deep cove base inside acts as a bumper for the cabinet.



Magnetic latches at either side of the opening keep the cabinet firmly in place.

The roll-away glassware cabinet shown in the background is built the same way as the dish cabinet except for two details: the addition of a $\frac{3}{4}$ " plywood glass organizer, and two shelves instead of three.

One advantage of making all roll-away cabinets the same size is that they'll be interchangeable. As storage arrangements change, you can swap cabinets.



BIG Idea: Floating basement stairs

PLANNING to remodel your basement in modern style? You could replace the rough steps with this suspended set of oak treads.

Begin construction by accurately boring $1\frac{1}{4}$ " holes in the treads, as shown—the rear hole just to the point where the bit tip shows through. Then drill the $\frac{1}{4}$ " holes to take the round iron pins.

In the stringer, cut $\frac{1}{2}$ "-deep notches to receive the treads, and fasten the stringer to the wall. Now put up the second joist parallel to the existing member and $1\frac{1}{4}$ " from it. Make certain you've firmly sup-

ported it at both ends. Nail trim board up.

From 1" black-iron or galvanized pipe, measure and cut the top two lengths. Mock up and level the first tread, so that you can mark the exact locations for the pipe. Install the pipes, then the treads.

(An alternate method of fastening pipes to joists: Thread top end of pipe. Spike second joist to first. Bore snug 1" hole up through center of double joist. Bore a larger hole crosswise in joists to take pipe nut. Screw pipe into nut. Plug hole.)

For a landing: Oak cleats support it; a double header between joists carries piping.

6

BIG Ideas

for your home



Triple-decker bed. This was the solution of Roy Spence of Fresno, Calif., when he came up against the problem of accommodating three sons in a single bedroom. Spence designed and built the handsome set of beds shown here, using $\frac{3}{4}$ " mahogany plywood. Each bed has its own headboard cabinet with a cupboard and shelves. The beds occupy only 38 square feet of floor space, cost \$160.33 to build, exclusive of mattresses.



Paneled divider. Soft-tone pine paneling in a "double-butterfly" pattern makes a handsome dining-area divider in this paneled room. The tongue-and-groove boards are blind-nailed through the tongue with finishing nails. Ornamental turned posts top the solid divider wall. A clear finish enhances the appearance.



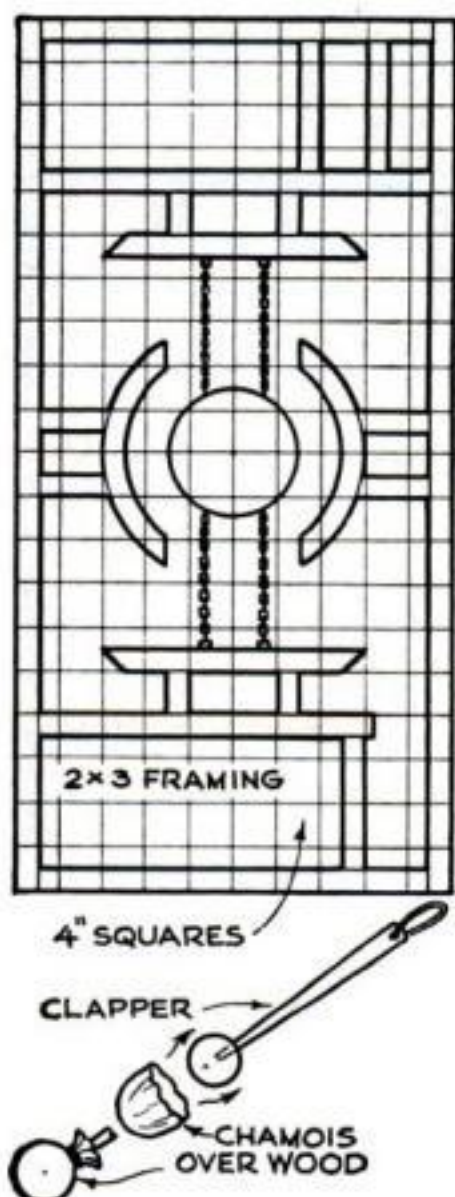
High-level planter. Tired of straining your back from stooping to tend garden plants? Build a planter at standing level. Here's a clever way to do it with concrete blocks. Angling the blocks gives the project a look of professional design. No finish is necessary, since the natural rough surface blends well with the surroundings.



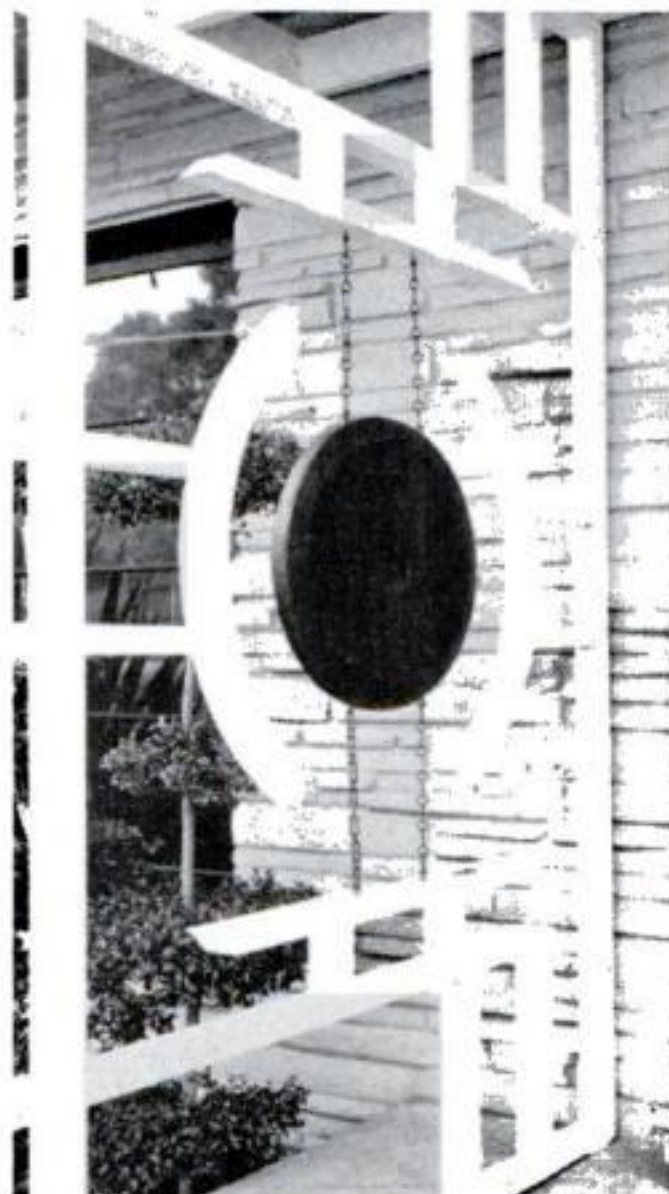
Swing-up sink. A hinged sink hides old-fashioned basement-type laundry tubs in the home of Lucien E. D'Aoust, Detroit. The sink is mounted in a $\frac{3}{4}$ " waterproof-plywood panel, topped and rimmed with



plastic laminate. The sink panel is attached at rear with a rustproof piano hinge. Doors at the bottom permit access to space below the tubs. Slots in the cabinet let air circulate around the tubs.



Framed Chinese gong. A handsome porch ornament, this gong serves a purpose, too—for calling the youngsters to meals, or even for visitors to announce themselves. The decorative framing was cut from two-by-threes, the curved sections from a two-by-six. The solid-bronze gong was bought as is. An effective hand-held clapper can be made by mounting a chamois-wrapped wood ball on a stick. Adapt height and width of framing to your porch.



Window seat. Here's a new use for inexpensive, melamine-surfaced hardboard—as a topping for a picture-window seat. The black and gold-streaked pattern gives it the look of marble. It's installed with adhesive.

Plastics: the **BIG** Idea in remodeling materials

New man-made items literally cover the house from attic to basement—and more are coming

By John H. Ingersoll

THERE'S good news if you plan to remodel soon. A warehouse-load of new building products is waiting for you. And they're due to make your home-improvement job easier, longer lasting, better functioning, and better looking.

One big reason: plastics. They're certainly not unfamiliar. We've been putting up acrylic resin awnings and patio covers, putting down vinyl tile and melamine counter tops ever since the end of World War II.

But all of a sudden plastics have mushroomed. They're in siding, piping, wall paneling, paint, new types of floor covering, sealers, light diffusers, soffits, room dividers, mortar, and windows, to name a few products.

Siding: Most unusual entry for the year

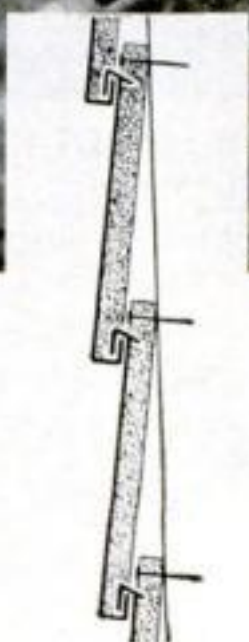


is a pure vinyl panel that looks like wood clapboard when installed. It is rigid polyvinyl chloride (PVC for short). It has a satin finish, comes in white, light gray, and light green, and is shipped in 12' 6" lengths that provide an 8" exposure when nailed up.

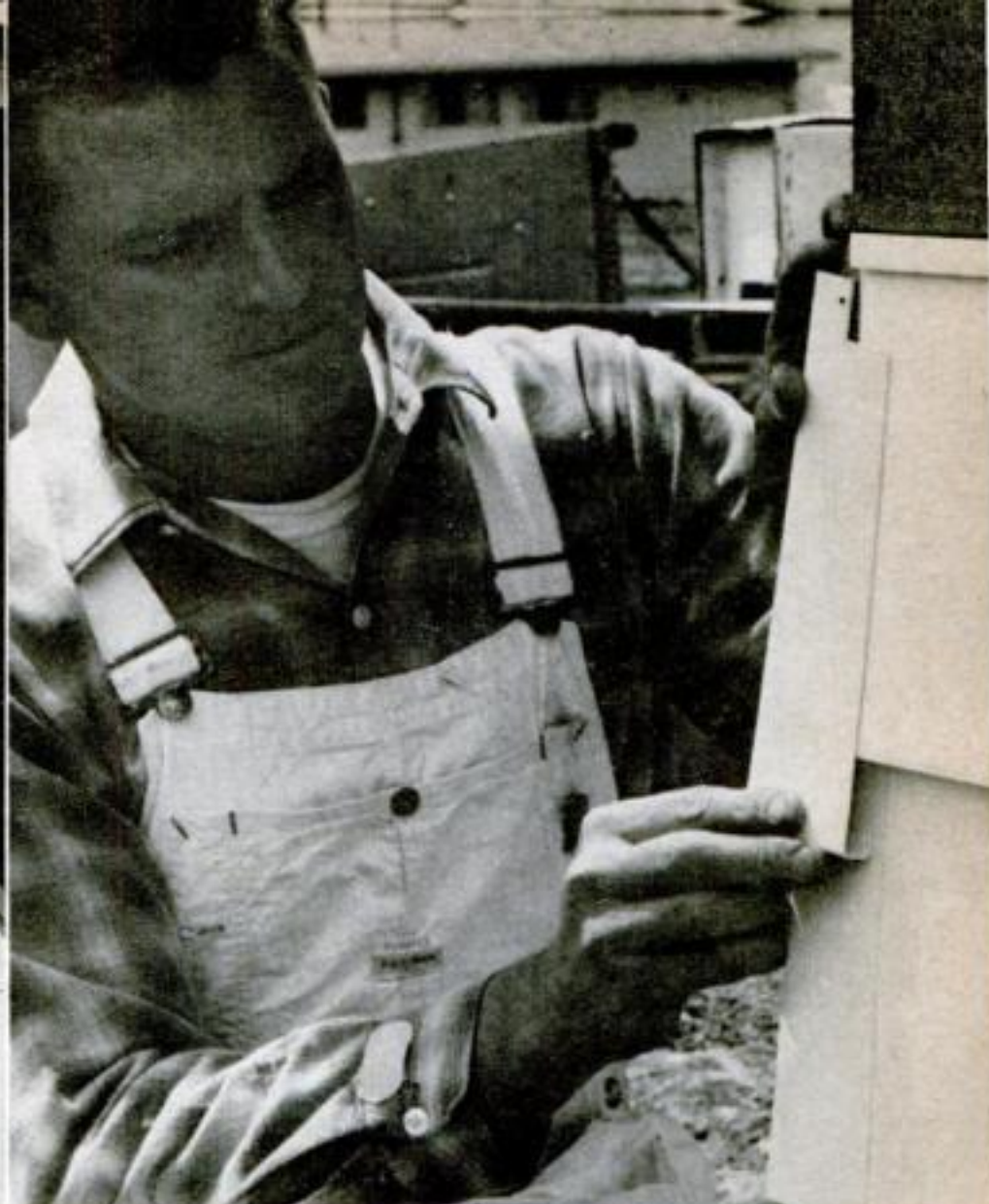
Since the product is new, how it's going to hold up would be hard to predict. Yet other PVC products (piping, gutters, downspouts) have lasted well for 25 years or more. It's fire-resistant, and suppliers claim it is dentproof, doesn't need painting, and can be washed clean when it's dirty. Prices are slightly higher than for aluminum siding, which costs between \$65 and \$95 a square (100 sq. ft.) installed.

In a competitive battle that promises benefits for us all, the more conventional siding materials have appeared with new finishes—coatings of plastics.

The two largest plywood producers, U.S. Plywood and Georgia Pacific, have unveiled "no-paint" sidings. One panel features a film of polyvinyl fluoride (Tedlar) bonded



Rigid plastic siding goes up over bare studs with backer of pre-grooved composition board. Backer provides some insulating value. Vinyl panels snap into place on board (see sketch, left). Not a



single nailhole penetrates the siding. Finished job has a clean, clapboard look. Accessories, such as corner piece above, are available. Plastic (PVC) has color all the way through. Prices start at \$65 a square (100 sq. ft.) installed. From Monsanto and from Mastic Corp.

Now—plastic siding, too



Variation on same theme is shown below and at right. This panel eliminates backer board; has pre-punched holes in flange for nailing, still provides a nail-less surface to weather, since panel bullnose overlaps flange. A fine-toothed hand-saw or power saw is used to cut panels. Price is about the same as for type above. Acorn Chemical.



to the surface, and the other has an overlay of synthetic rubber (Hypalon). Both are expected to be long-lasting—perhaps more than 15 years—and both will cost more than conventional plywood sidings.

An aluminum siding by AlSCO has also joined the parade. It has a Tedlar film bonded to its surface, and promises a longer life than acrylic or vinyl finishes.

To wind up the group, Masonite offers a hardboard siding with a coating of polyester film (Videne) and guarantees it for 10 years.

Awnings and patio covers. In the past, most plastic panels have been made of fiberglass-reinforced acrylics. Two new developments have improved color retention, up to now one of the big snags. The first is a standard panel with a coating of Tedlar film by Filon and Structoglas. The second is an awning panel of PVC by Barrett.

Paint: Although the acrylic and vinyl paints (generally lumped under the name latex) have been around awhile, it's well to consider them for repainting either ex-

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Where to buy what you want

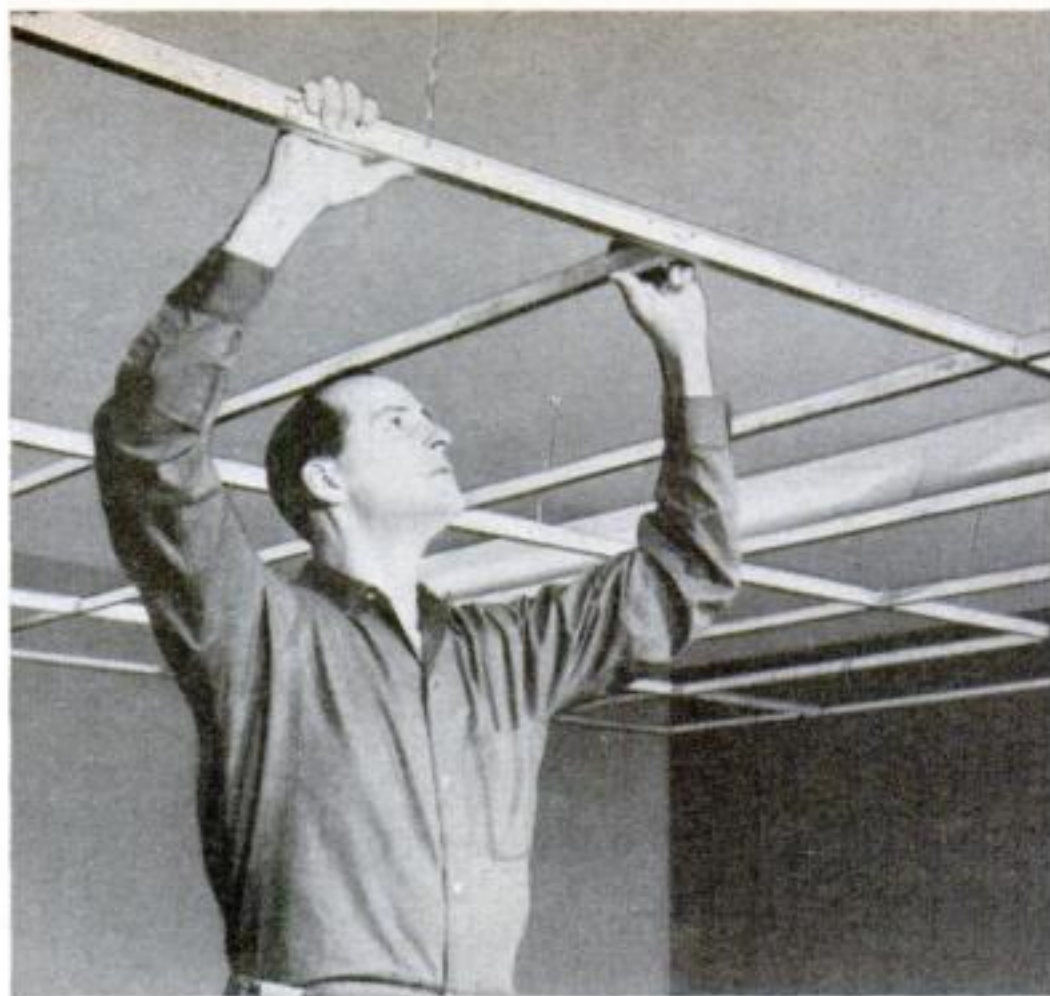
Products mentioned generally should be available from your local building-supplies dealer. If not, makers' names and addresses are listed at the end of the article for your convenience.

.....

terior or interior of your home. They cost slightly more than oils—about \$8 a gallon—but they last longer. There's also an alkyd-base aluminum-type paint available now to coat asphalt shingles or masonry walls (from Sapolin). It's mixed only in pastel colors. Then, there's the new epoxy coating developed for bath walls, tile, and fixtures [PS, June].

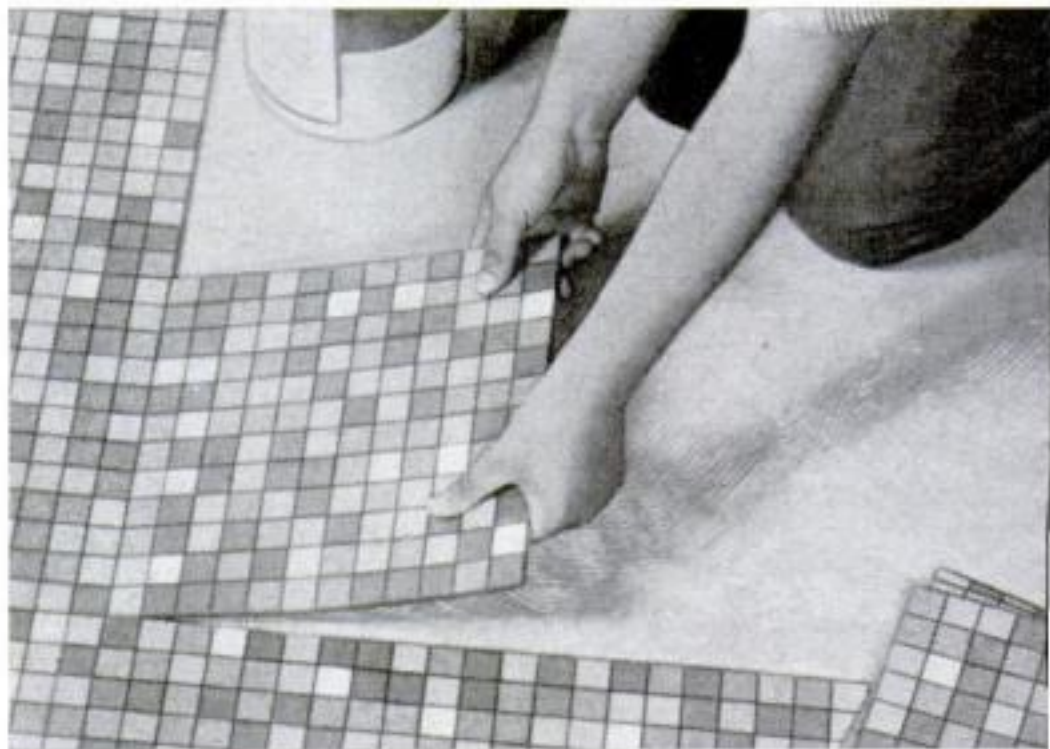
Gypsum board, windows, sealer. If you're adding or remodeling a bath, consider National Gypsum's new vinyl-surfaced gypsum backer board that permits watertight ceramic-tile installation with adhesive.

Putting in a new window? One supplier (Malta) has developed a unit that features standard ponderosa pine for frame, jamb, sill, and casing, and rigid PVC for sash and weatherstripping. A single-hung window, 20" by 17", costs about \$9.25. Another producer (Woodall) offers a fiberglass-reinforced plastic sill that has a gray



It's possible to put up

New dropped-ceiling systems are ideal for remodeling, since they require no patching of old ceiling, easily drop under ductwork and piping in a basement. Grid is made up of L- and T-



Ceramic tile goes down like vinyl

Speedy installation of ceramic tile is made possible with this flooring material. Its 1" squares are set in vinyl. The material goes down with standard floor mastic. Stylon Corp.

marble-like design, is 4 $\frac{3}{4}$ " wide, up to 72" in length.

A product that's ideal to solve your wet basement problems has been developed of epoxy resins. Epoxite sealer by Boyle-Midway is applied on the inside of masonry walls. Price for a complete basement job will run from \$75 to \$100.

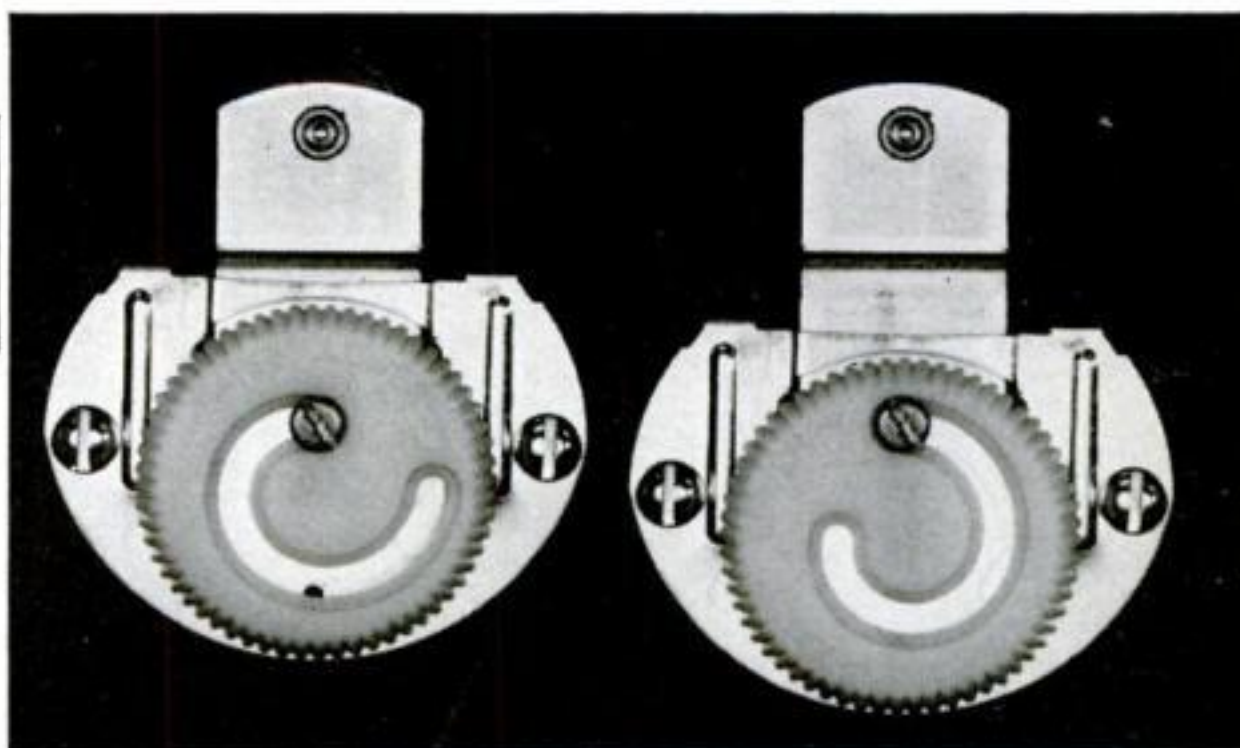
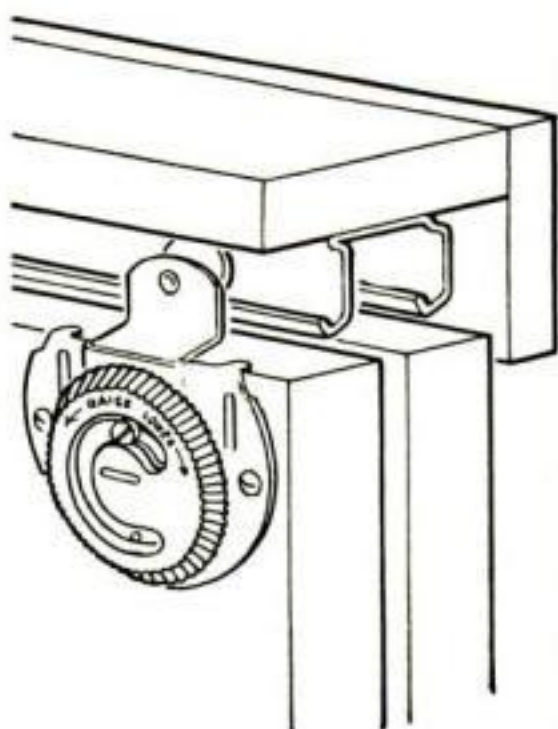
Glass block. Pittsburgh-Corning has an all-glass building block that's a world apart



this entire ceiling system in an evening

shaped steel members (some manufacturers use aluminum). No special tools are needed. With main runners up, cross-tees snap into predetermined locations (left photo). Wall row of

acoustical panels is cut to fit, but otherwise panels drop in as is. Plastic panel is substituted when light fixture is on old ceiling above. From Armstrong Cork Co. and others.



Easy way to hang a sliding door: just "dial" its height

Getting sliding doors to hang level is no problem with these new adjustable hangers. You turn a plastic wheel, and a curved slot acts like a cam, moving the hanger arm up or down.

Turning the wheel one way raises the door; the other way lowers it. A set of four hangers plus track sells for approximately \$5 from Stanley Hardware, New Britain, Conn.

from the old glass squares we knew in the 1930s. It's made in oblong and square shapes with a recessed clear-glass pattern in the center. The raised portion is fired ceramic with a concrete-gray textured surface. It's a natural for a garden divider, or an end wall in a family room.

Ceilings. Latest thing overhead isn't ceilings, but ceiling systems. At least two dozen manufacturers have produced a combina-

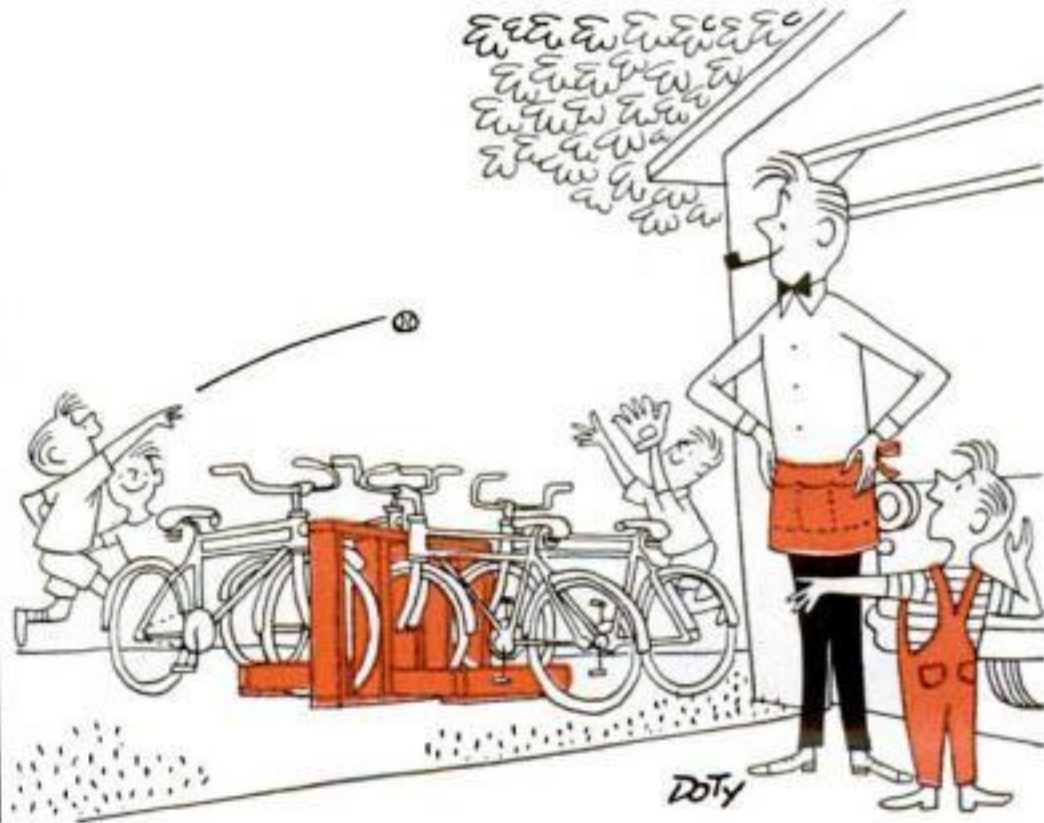
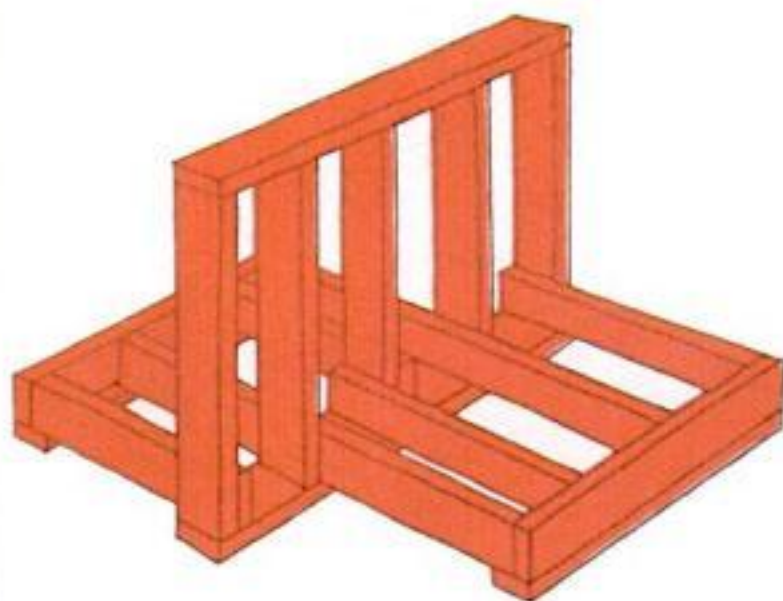
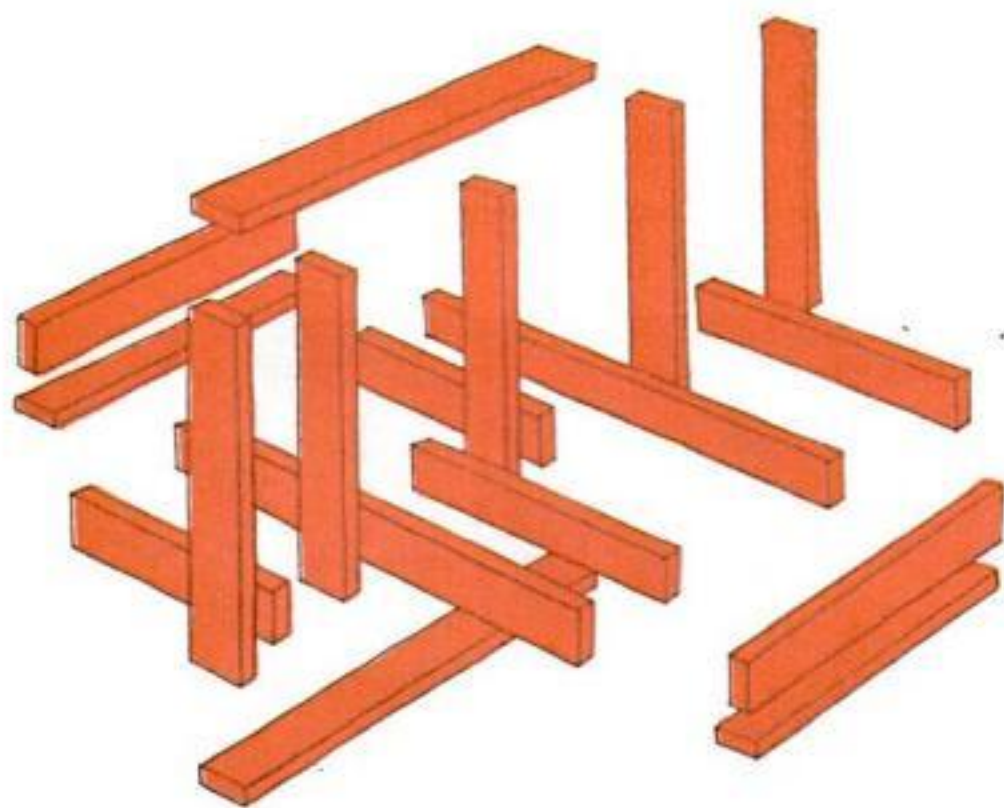
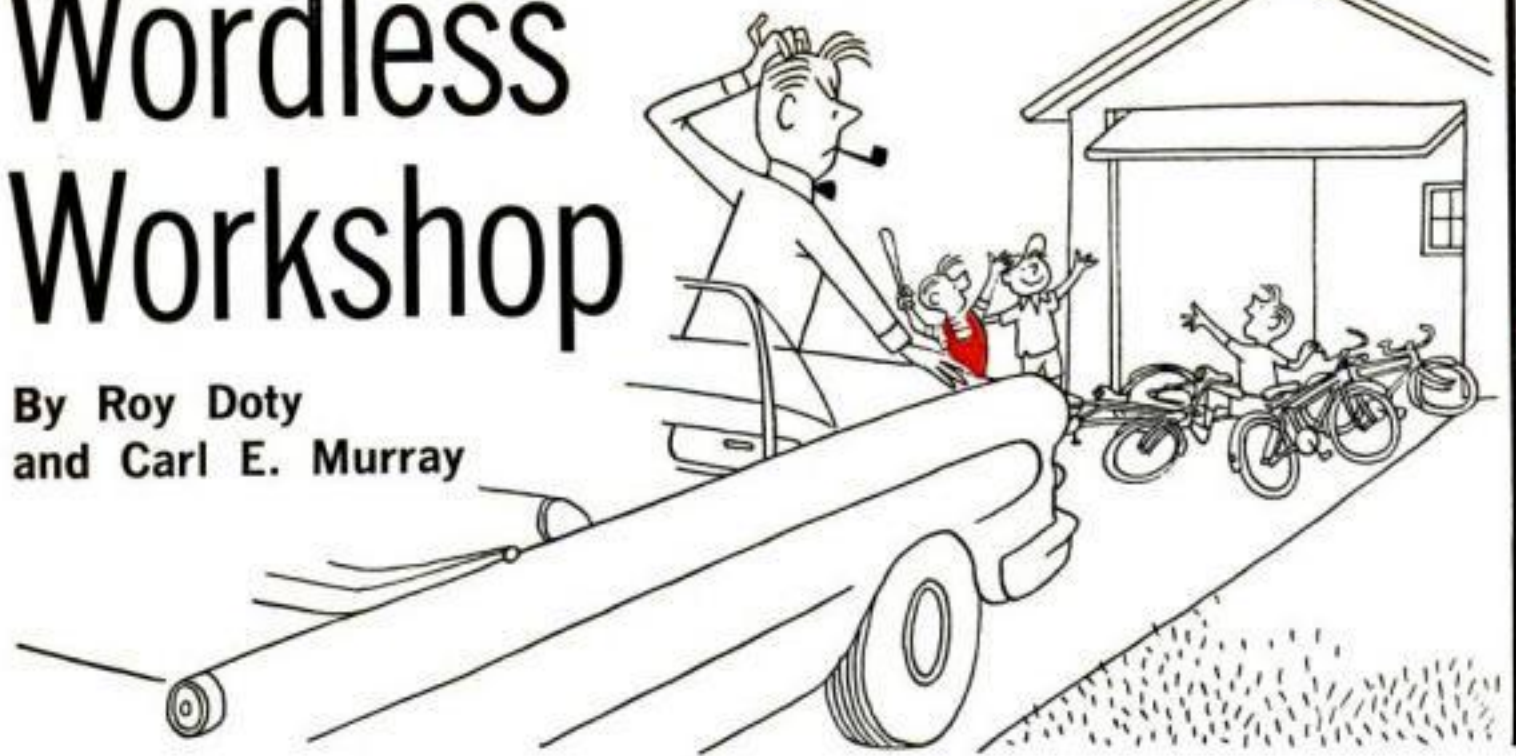
tion of aluminum grids and panels to make up what amounts to a dropped ceiling. Some use fibrous acoustical panels, plus one or two plastic sheets to diffuse lighting from above. These are well suited to basement remodeling, as the photos show.

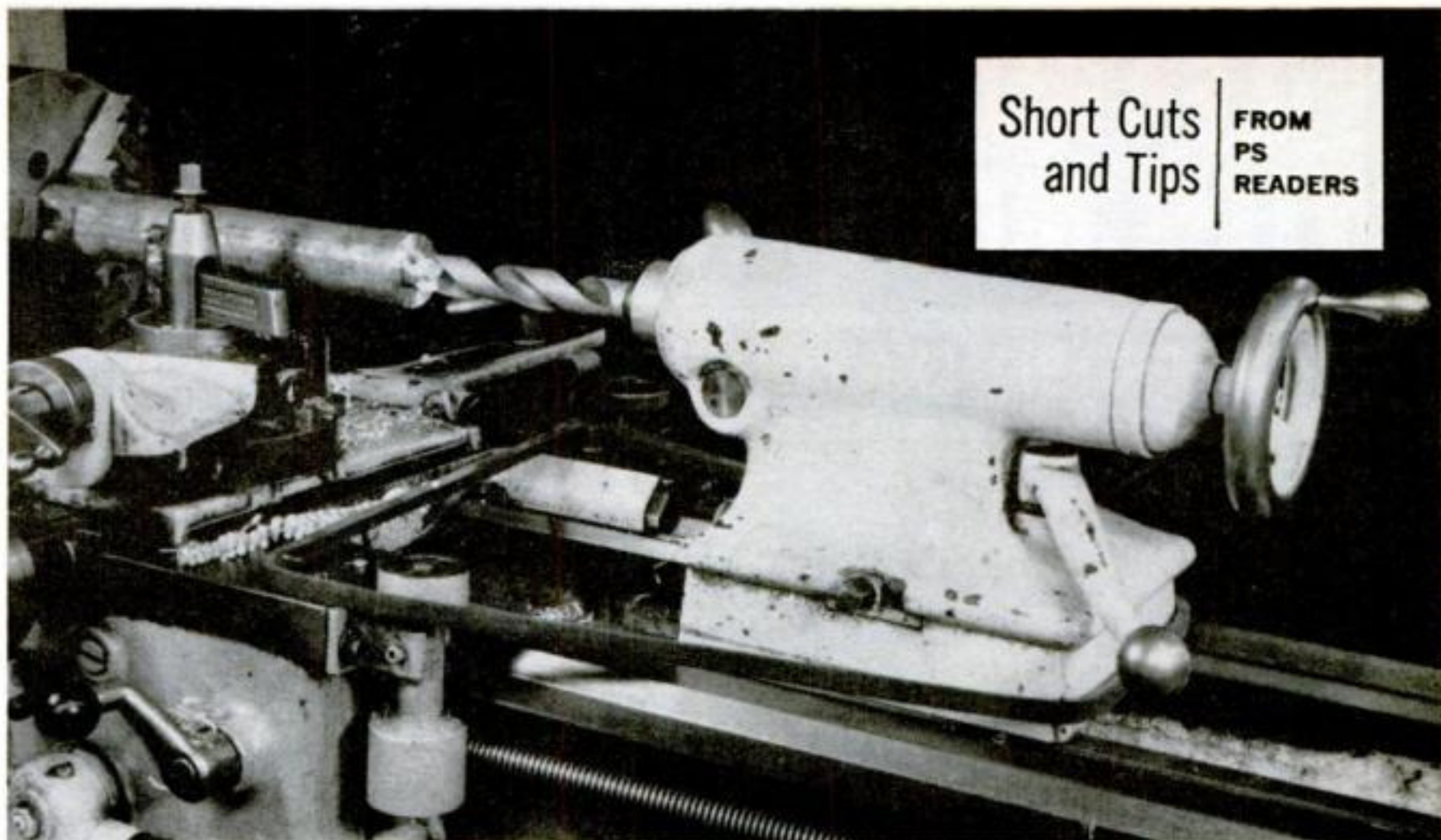
Other systems include nothing but plastic panels, and are meant to make an entire luminous ceiling—in a bath or kitchen for

[\[Continued on page 184\]](#)

Wordless Workshop

By Roy Doty
and Carl E. Murray





V belt pulls tailstock for drilling

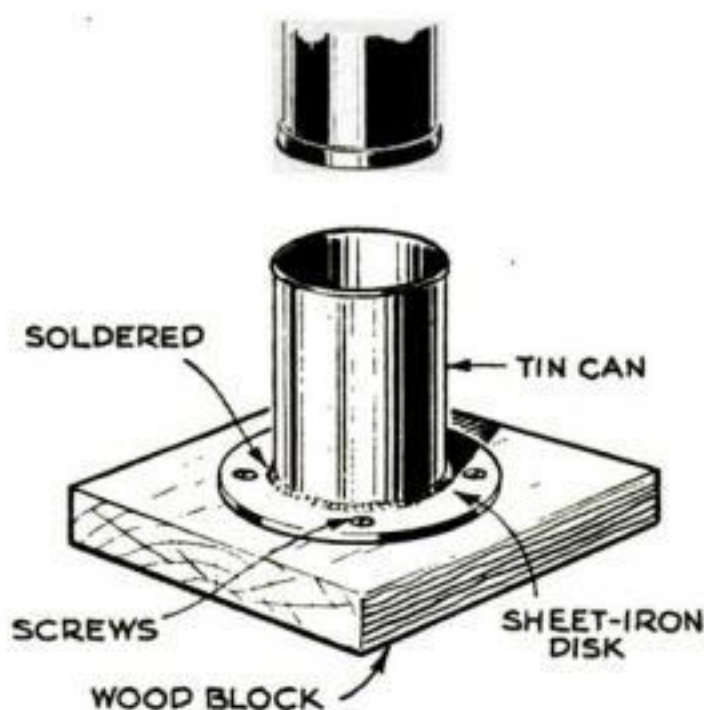
Feeding with the tailstock handwheel can become tedious when you drill large-diameter or long holes in a lathe. But the carriage can be power-fed, and I make use of this to move the tailstock along the bed instead of hand-cranking the spindle. I

simply connect the carriage to the tailstock with an old V belt and let it slide on the well-oiled bedways. Loosen the tailstock clamping bolt just enough to permit movement but not so much as to make it loose on its seat. On smaller lathes the belt can be looped around the compound base.—*H. J. Gerber, Menomonie, Wis.*



A clipboard can beat the wind

Your notes to delivery men won't blow away in a strong wind, or otherwise get lost, if you mount a clipboard clip near the delivery entrance on the porch banister, post, or door frame as pictured above. If you want to use the whole clipboard, cut it down in width to suit the space available.—*Frank H. Lewis, Doraville, Ga.*



How to make a propane-torch stand

To keep a propane torch from tipping over when you put it down during use, make this simple stand from a tin can of suitable diameter. Solder the can to a disk of heavy-gauge sheet metal and screw the disk to a wood block. I found the stand especially useful when heating floor tiles for cutting.—*V. H. Lamoy, Upper Jay, N.Y.*

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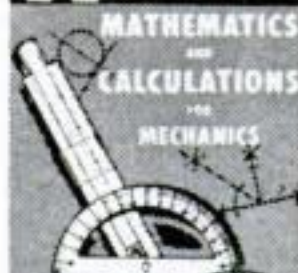
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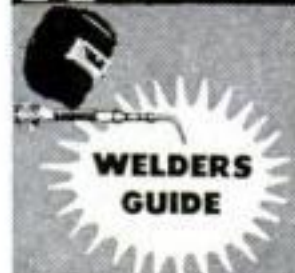
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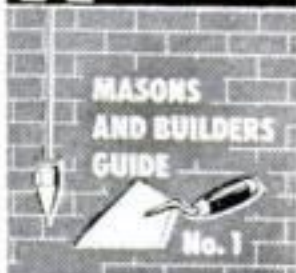
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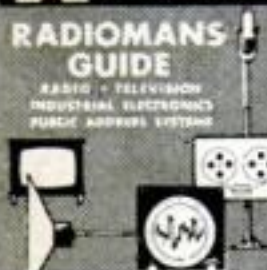
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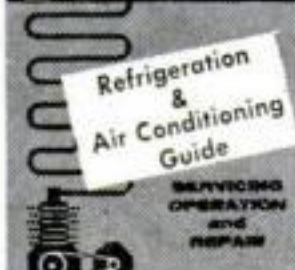
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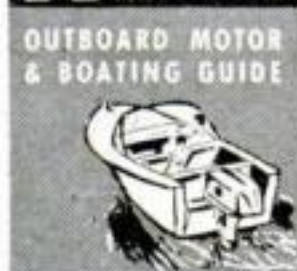
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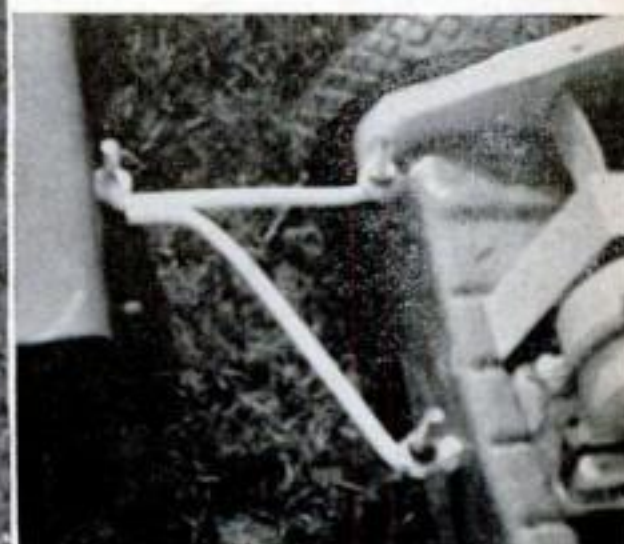
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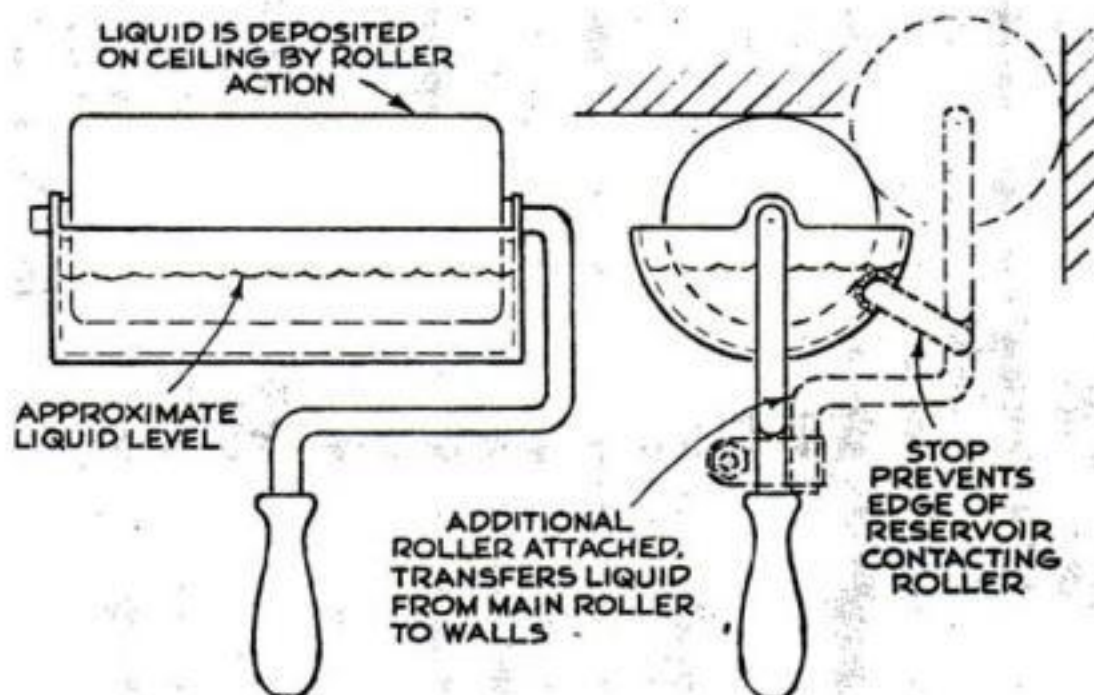
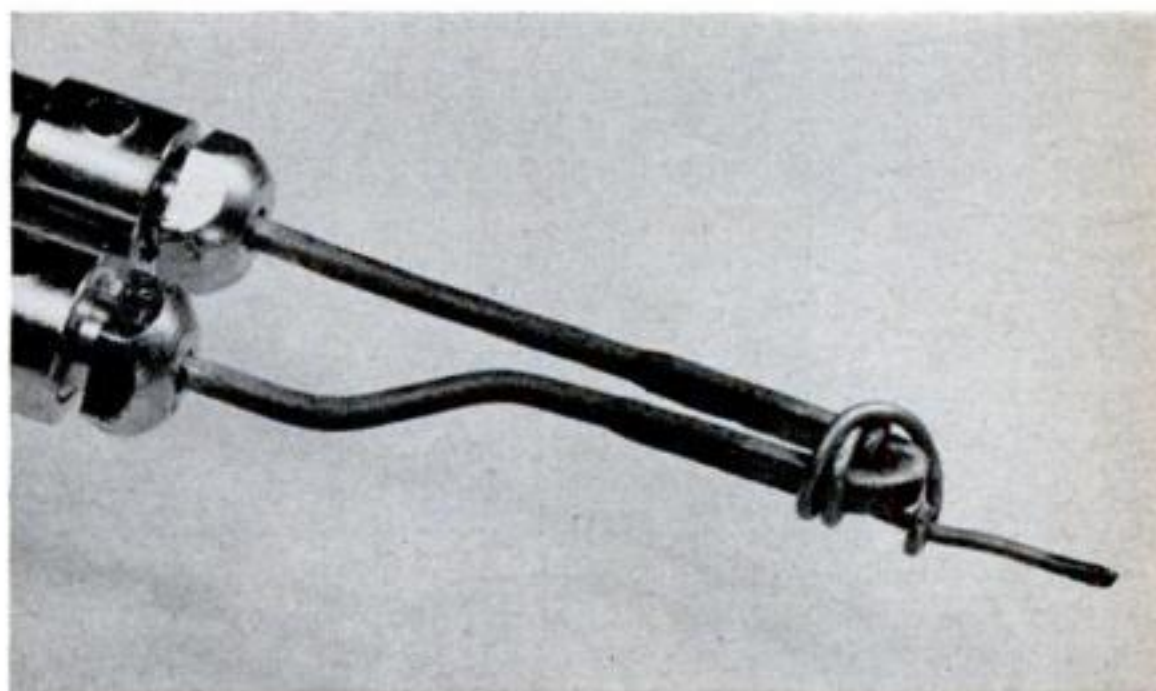
Tandem mowers cut wide swath

Secret of the lawn-mowing combine above is a simple three-point hitch shown in close-up photo at right. Riding the lead machine, with my follower offset, I leave

a handsome 40" swath behind—cutting my mowing time in half. For trimming around trees, shrubs, and driveway, I uncouple the hand mower—a simple, quick job. The unit tows and corners without skipping.—*Charles F. Coulter, Bucyrus, Ohio.*

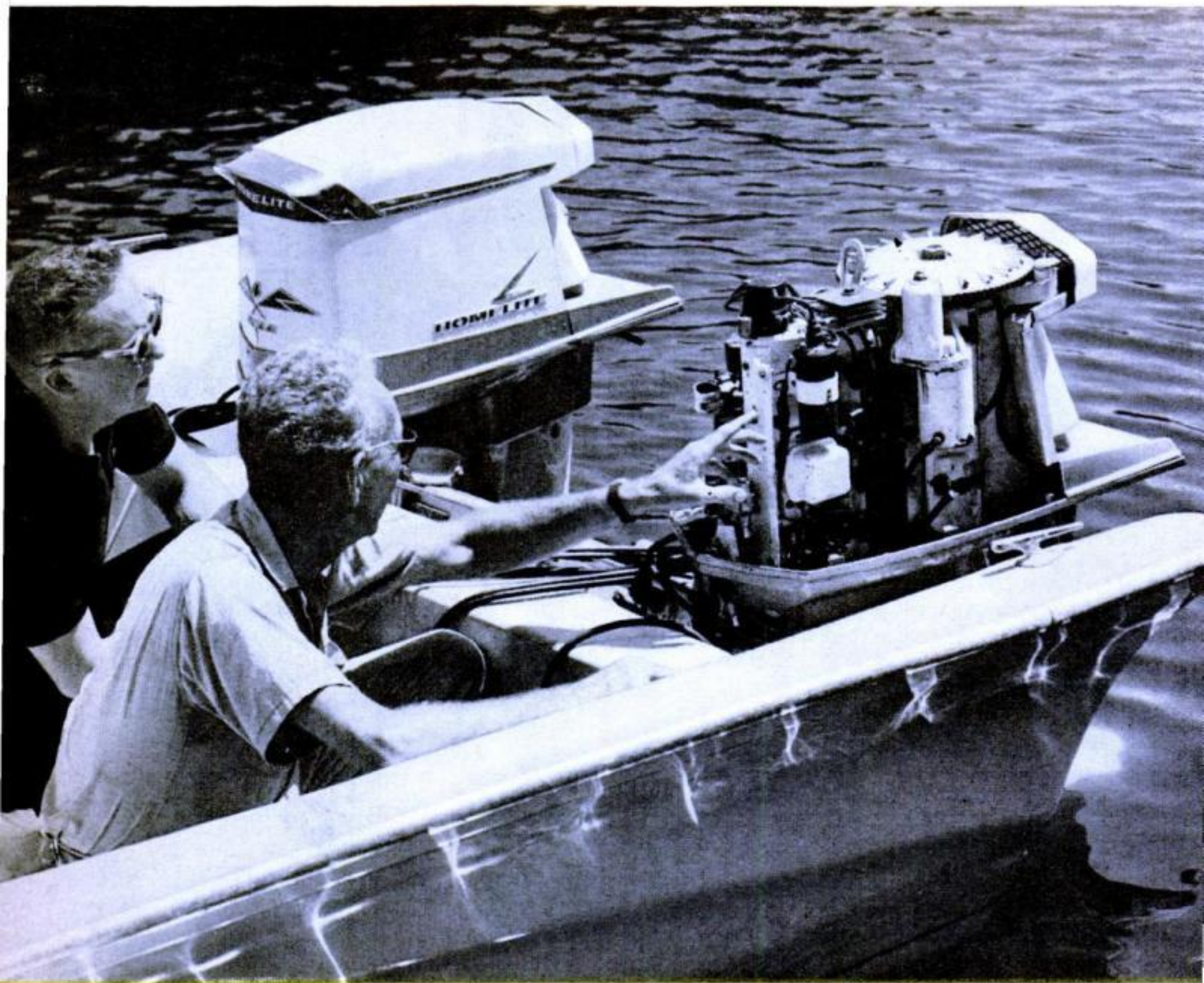
Solder-gun extension for plastic work

Welding or cutting thermoplastics is easier if you wrap a length of soft copper wire, about 14 gauge, several times around the "hottest" part of the solder-gun tip, with one end projecting $\frac{3}{4}$ " or so. The wire can be flattened, pointed, or bent for working on jobs where space is restricted.—*Walter E. Burton, Akron, Ohio.*



Paint roller adapted for soaking wallpaper

Deciding to remove some ceiling paper, I was afraid a steamer would damage the side wallpaper. Then I got my idea of using a paint roller, modified as shown in the drawings. I cut a big fruit-juice can axially to form a water reservoir. Then I drilled a hole in tabs left at each end, to take the roller shaft. It worked so well I added another roller for use on sidewalls.—*Donald L. Miller, Horseheads, N. Y.*



One-of-a-kind outboard:

Jim Roe Tests the Homelite 4-Cycle

Some owners are now using this unique motor for their third season. What's it like? Come along and find out

By Jim Roe

PHOTOS BY HARRIET ARNOLD

IN THE world of outboard motors, the lone individualist is the Homelite. Of all the six to seven million motors clamped on the transoms of American boats, only a handful are four-cycle engines. The rest are and practically always have been two-cycle.

Born as the power plant of the before-its-time Crosley automobile, the Homelite engine was switched from highways to waterways by another man with vision, Lou Faegol. Now it has been re-engineered and massively tested by the resources of Textron—a multi-interest organization. Among other things, the Textron people have turned out more than 35 million two-cycle engines largely for home lighting plants and chain saws.

Why should one motor outfit go north, figuratively speaking, when everyone else is going south? The way to find out, I figured, was to test this maverick hunk of machinery and talk to the men with the four-cycle gleam in their eyes.

I met up with my first Homelite (there is just one model—a 55-hp.) on a blistering-hot July day at Boynton, Fla. This is the main marine laboratory for Homelite. Director George Barber gave me a warm welcome and an enthusiastic crew leaped at the chance to show me what made the Homelite tick.

Since this first ocean test I have also operated the motor in Midwestern freshwater lakes, to further try its capabilities.

Now, there are a great many good outboard motors, but it's rare indeed that a web-footed motor-tester gets hold of something really different. The Homelite qualifies as one of those rare cats with a new twist to its tail.

Before we go into the pluses and minuses, let's review what engineers mean when they say two-cycle or four-cycle.

A two-cycle has just two strokes to its cycle—a combination intake-compression stroke, and then a combination power-exhaust stroke. The four-cycle has four strokes in its cycle: intake, compression, power, and exhaust. For each piston there is a firing stroke every other revolution of the shaft, instead of every revolution as in the two-cycle.

When you draw up two columns on a sheet of paper, one of the first things you put down on the "good news" side is that the four-cycle Homelite burns straight gasoline. In crass commercial terms, this means

CONTINUED



For trolling, the Homelite really loiters. Fueled by straight gasoline, it can be run for long periods at slow speed without fouling the plugs.

WHAT WE'RE TESTING

Type: 4-cycle; 4-cyl.; water-cooled; electric - starting; 55 hp. at 5,500 r.p.m.; 59.4-cu.-in. piston displ.; bore, 2 $\frac{1}{4}$ "; stroke, 2 $\frac{1}{2}$ ".

Crankshaft: 5 main bearings.

Carbs: Dual, fixed jets.

Drive: Gearshift; 15:28 ratio.

Fuel: standard gasoline.

Lubrication: High - pressure, forced; cap., 2 qt.

Gas-tank cap.: 6 gal.

Electric supply: 10-amp. alternator-generator.

Weight: 227 lb.

Price: \$960 f.o.b.



Owner's like 'em. Here's what a half-dozen say about their



Erwin L. Becker, Brightwaters, N.Y.: "It gives me twice the performance of my old two-cycle 35-hp. engine—at half the fuel consumption. However, the steering-pulley mounts on the engine need to be stronger."



Richard Harding, Chester, Pa.: "After six hours break-in time, I adjusted the carburetor—and since then not a screwdriver or other tool has touched my engine. I push a 22-foot Trojan cabin cruiser, total weight 3,500 pounds. She makes 21 m.p.h."



Robert G. Nyberg, Morris Plains, N.J.: "It's excellent in performance and fuel economy. The lack of smoke and oil fumes is wonderful. On an 18½-foot boat I was able to get 7 miles a gallon at 25 m.p.h."

you are chugging along on gas that costs about 32 cents a gallon, instead of a premix of gasoline and oil that costs 50 cents a gallon. Besides this, the four-cycle principle makes for more complete combustion of the fuel, and thus still more efficiency.

There are claims to the effect that the Homelite will cut your fuel costs clear in half. I'm not sure the percentage is always quite that good, but you've got to admit that every time you buy a gallon of fuel at 32 cents instead of 50 cents there's enough money left for a couple of cokes.

In one test, with an 18-foot boat carrying four adults and traveling at 32 miles an hour, the motor burned 3½ gallons of gas an hour. That 32 miles an hour is pretty respectable speed in anyone's league, and 3½ gallons of gas is a pretty small scoop of oats for the horses. These gas figures can vary all over the lot, of course, and your own results could be better or worse—depending on the boat, the load, the water, and the speed. But it's obvious that the Homelite is willing to live with you even if you're on a budget. This low-cost carrying capacity has made the motor a favorite of many houseboat operators.

The second thing I put on my test-report column of advantages is the Homelite's ability to run long periods at idle or trolling speed, without fouling the spark plugs with unburned oil. This is important. You

can dash out to your favorite fishing ground at good speed, then troll all day, with the same motor. You can idle through harbor channels and approach docks with confidence that fouled plugs won't stall your engine just as you're trying to impress dock-loungers with your seamanlike approach.

The reason is that the engine is burning just gasoline, not a mixture of gas and oil.

Ideal idling. For some tests under slow-idle conditions, I took a Homelite-powered 16-foot Lyman round and round the Chain 'O Lakes district north of Chicago at the Illinois-Wisconsin border. I've had lots of experience idling through the long and rigidly patrolled channels that connect these little lakes. I've sniffed my share of exhaust gases, occasionally had a stall, and always left a cloud of blue smoke when I opened 'er up to go across the next stretch of open water.

The Homelite acted as if it had read the book. There was a freedom from fumes, a smooth idle, and instant smokeless response when we were in the clear and could shove the throttles to the wall. So here's a real plus mark for fishermen, channel navigators, and ladies with delicate nostrils.

Another plus shows up for skiers. A four-cycle engine on a boat—just as in your car—delivers a smooth flow of thrust quickly as you accelerate. There is no lag while the motor builds up revs. You can get a

Homelite outboards after up to three seasons of use



*Matthew C. Zebrowski,
Bayonne, N.J.: "Very
satisfactory. I found my
Homelite to be very good
moneywise and powerwise.
But I wish there was
some way to keep oil
from leaking out the
oil filter when the
engine is tilted up."*

*Kurt Birkholz,
River Edge, N.J.: "It
is perfect!
If possible, though,
I'd like to see
them try to reduce
the engine weight
on future models."*

*Charles T. Barnes,
Danbury, Conn.: "I think
the Homelite is a terrific
engine—and I have
recommended it to everyone
interested in an outboard.
The use of solenoids
for shifting would
be an improvement
in operation."*

skier or several skiers up a little more smoothly and quickly. In fact, many people report their 55-horse Homelite gets skiers up faster than some higher-horsepower two-cycles. This is not to imply that the 55-hp. Homelite packs the punch of a 65-, 75-, or 100-hp. motor. For with comparable boats, loads, and in the same water, the higher-horsepower motors will pull alongside and

go on ahead. It's just that on the pickup from idle to full power, the four-cycle delivers thrust a little more quickly in the early stages of acceleration.

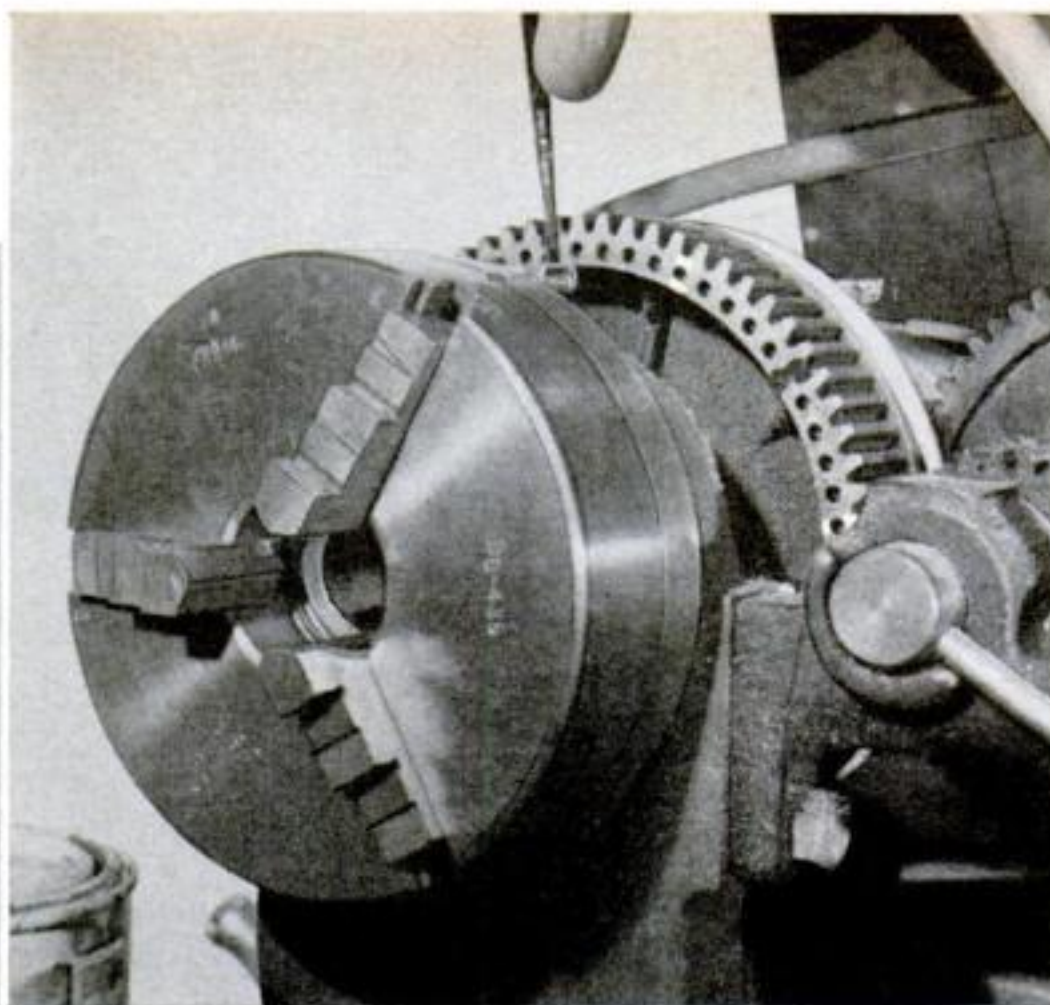
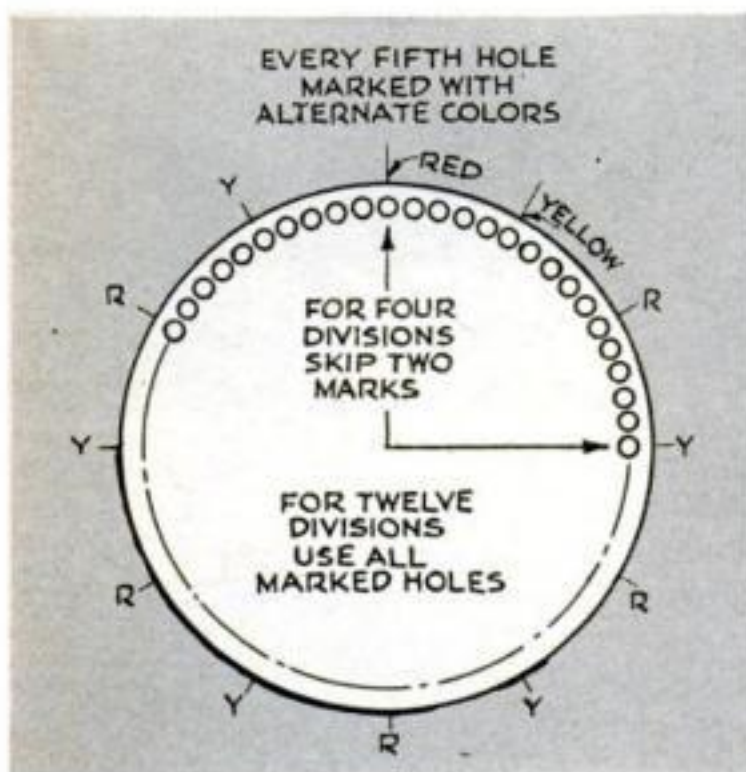
The Homelite is not described or sold by even its most zealous friends as a hopped-up racing motor. It's lively and responsive but its principal advantages are in lower

[\[Continued on page 182\]](#)



The four-cycle Homelite has speed, too, when you want it. During trial runs, I found that it

passed the ultimate test: My teen-age son, Jim Junior, was completely happy with it.



Color marking on lathe index head

You needn't count holes for the most-common divisions if you mark every fifth hole with paint—and there'll be less chance for making errors. Using two colors, spot every tenth hole with red, for example, and every fifth one between these with yellow, marking 12 holes in all. Now, in-

stead of counting, you can index divisions as follows: **2 divisions**—two opposite holes of the same color; **3 divisions**—every other red or every other yellow; **4 divisions**—alternate colors, skipping two marked holes each time; **6 divisions**—every red or yellow marking. For other indexing, you'll have to count the holes, as usual.—*Harry Walton, White Plains, N.Y.*

▶▶▶I came across an old cuckoo clock that had been in storage for a long time. Silverfish and roaches had eaten the paper bellows completely, and my clock seemed doomed to a life of silence. I used some of

the new polyethylene plastic (from a freezer bag) and made new bellows. They have been in continuous service for more than three years and are still working perfectly.—*George A. Wendland, Hearne, Texas.*

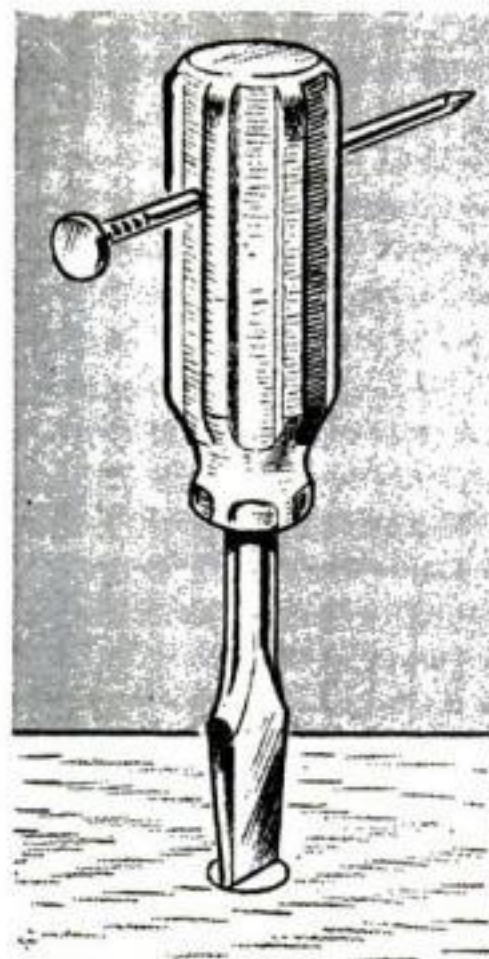


Ice cubes water planter

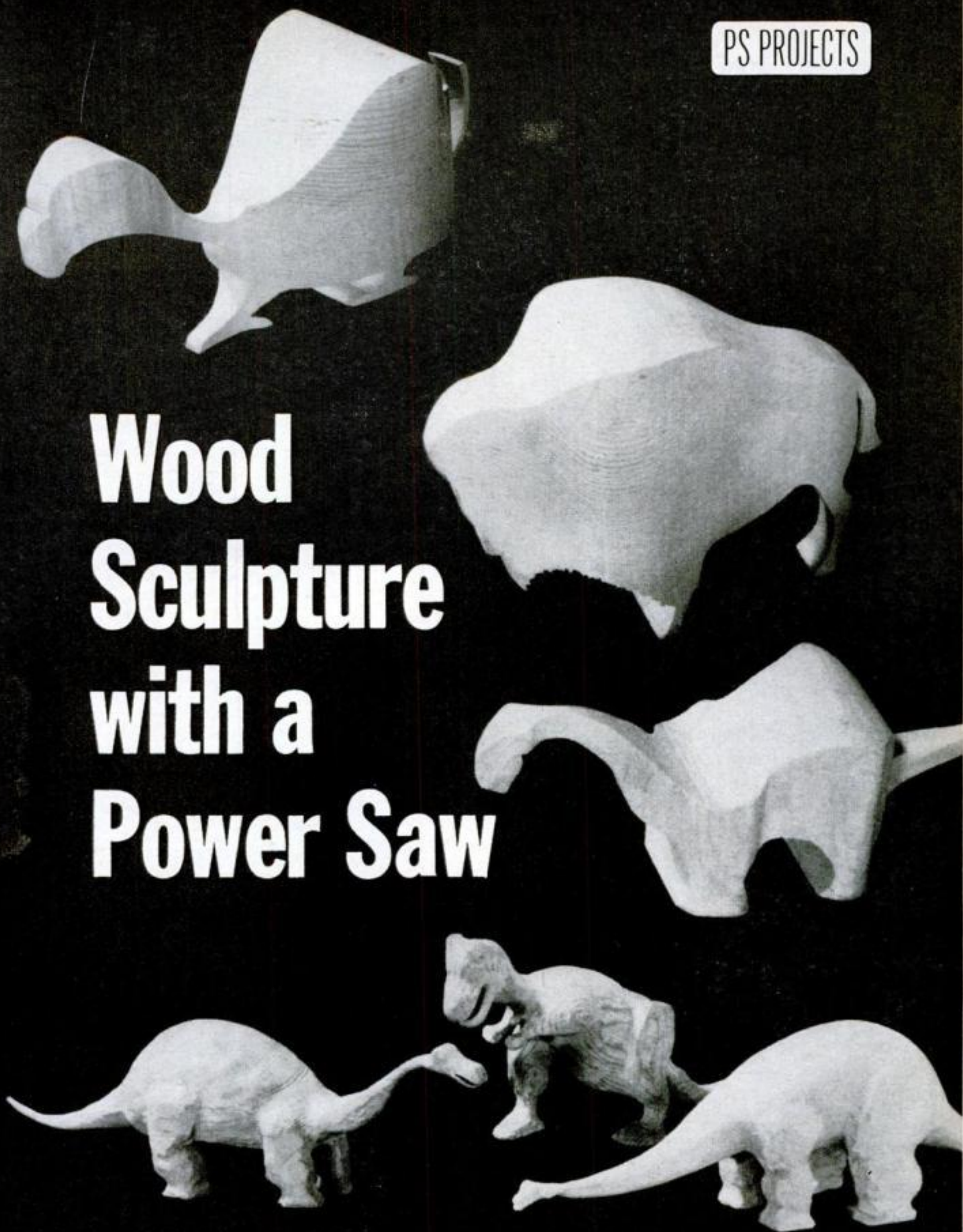
My problem was getting at some hanging pots of hardy plants that were difficult to reach with a watering can. I found an easy solution by placing a few cubes of ice on the dirt (left). Many plants are tough enough to stand ice water.—*V. J. Plesko, Superior, Wis.*

Spike gives added leverage

When a stubborn or frozen screw defies a plastic-handled screwdriver, drill a hole through the handle and insert a stout spike for greater leverage. The hole should be large enough for easy removal of the spike.—*G. E. Hendrickson, Argyle, Wis.*



Wood Sculpture with a Power Saw



Want to try it? Turn the page to see how

How to Saw Wood Sculpture: 8 Steps

By R. J. De Cristoforo

IF YOU have ever shaped a cabriole leg or made other compound cuts with either a bandsaw or jigsaw, you'll find it a snap to cut wood into interesting little sculptured figures.

Even if you have spent years in a well-equipped shop, it's possible you've never had the opportunity to try such wood shaping—the uncluttered lines of modern design don't call for it. So here's a chance to practice the procedure without confining it to outmoded chair or table leg designs.

To start, you draw full-size side and top views of the subject, reducing the profiles to lines indicating the basic shape. When the figure comes off the bandsaw, it should be recognizable without additional carving. The figures can be realistic or they can be caricatures.

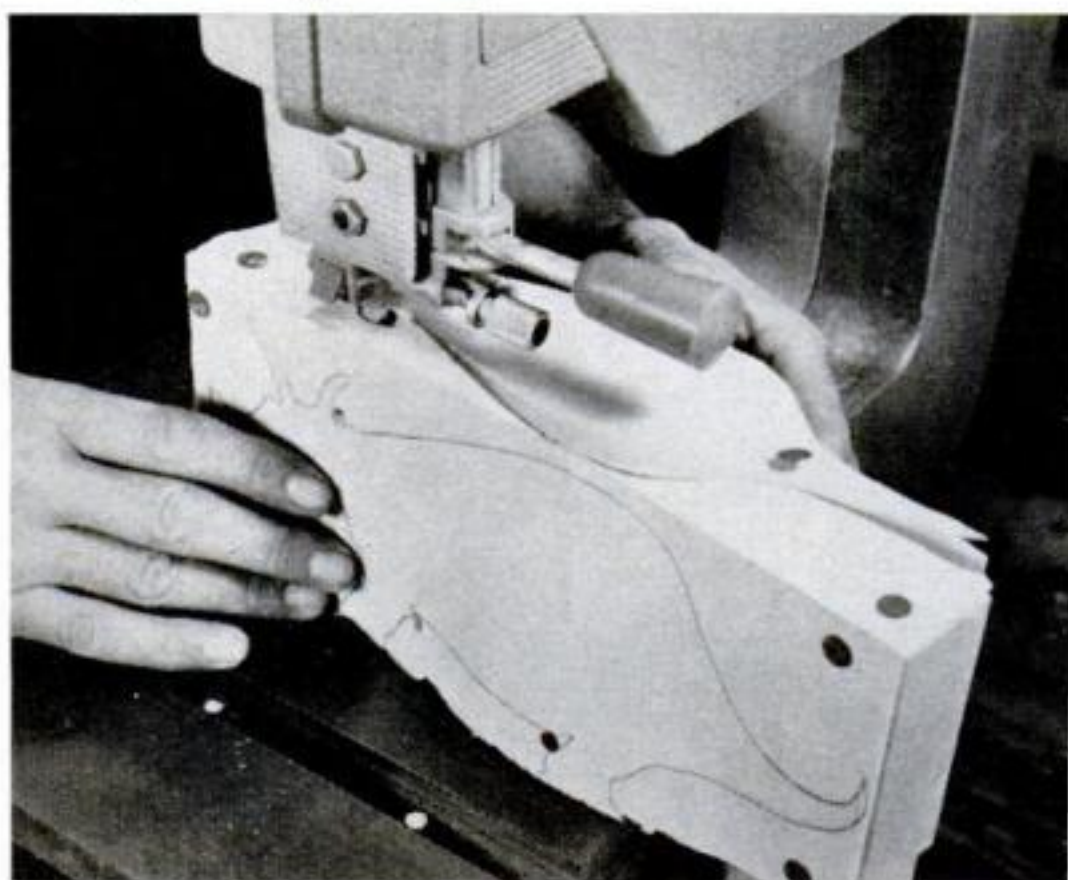
Depth-of-cut on your equipment does not limit you as much as you might think, although it should be considered when you draw the outlines. A tall figure can be cut by placing it on its side. A long figure is no problem at all.

You can work with solid wood or built-up, glued blocks. The glued block has some advantages: You can utilize scrap stock or work with contrasting woods for special effects—zebralike stripes, for example—by alternating light and dark woods. Softwood is easiest to work with. Try your first projects on pine, walnut, or redwood. Size the block so it is at least $\frac{1}{4}$ " wider, higher, and longer than the figure. Rubber cement or thumbtacks will hold the pattern to the block.

A small bandsaw blade ($\frac{1}{8}$ ") with a minimum amount of set will produce the best



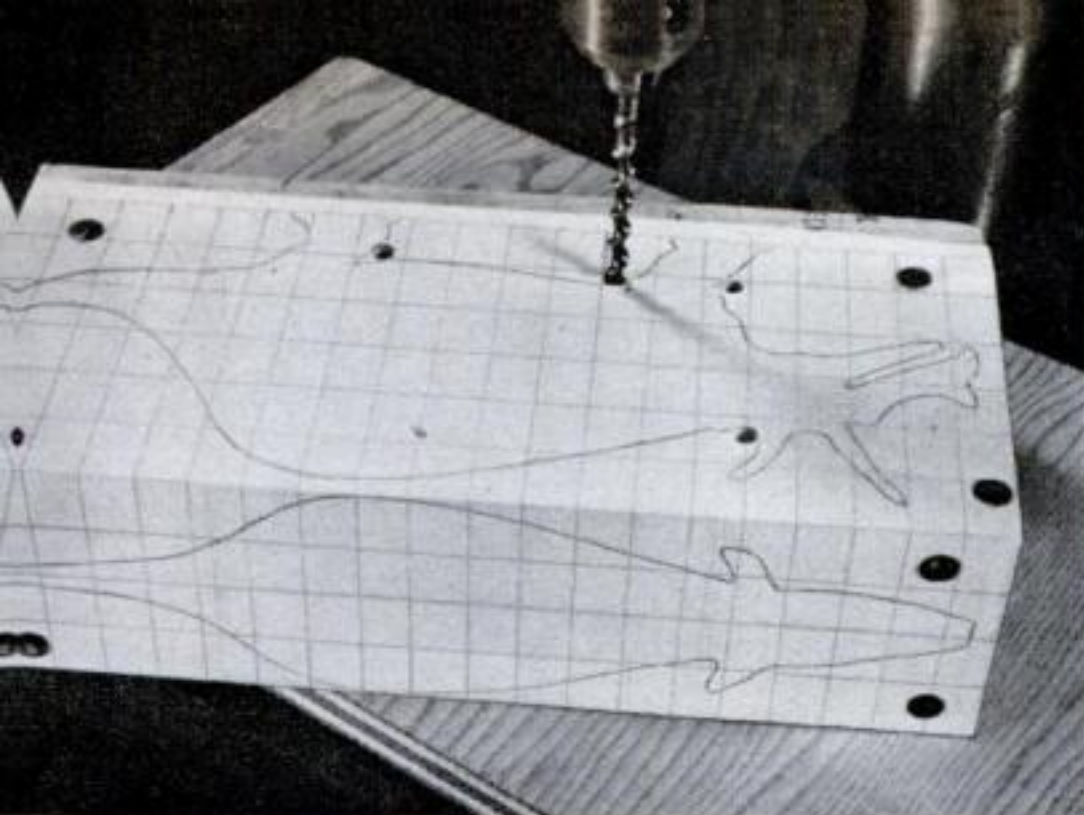
1 Patterns for saw sculpture can be taken from natural-history books—or page 50 of this issue of POPULAR SCIENCE, as above. Animal figures are good subjects.



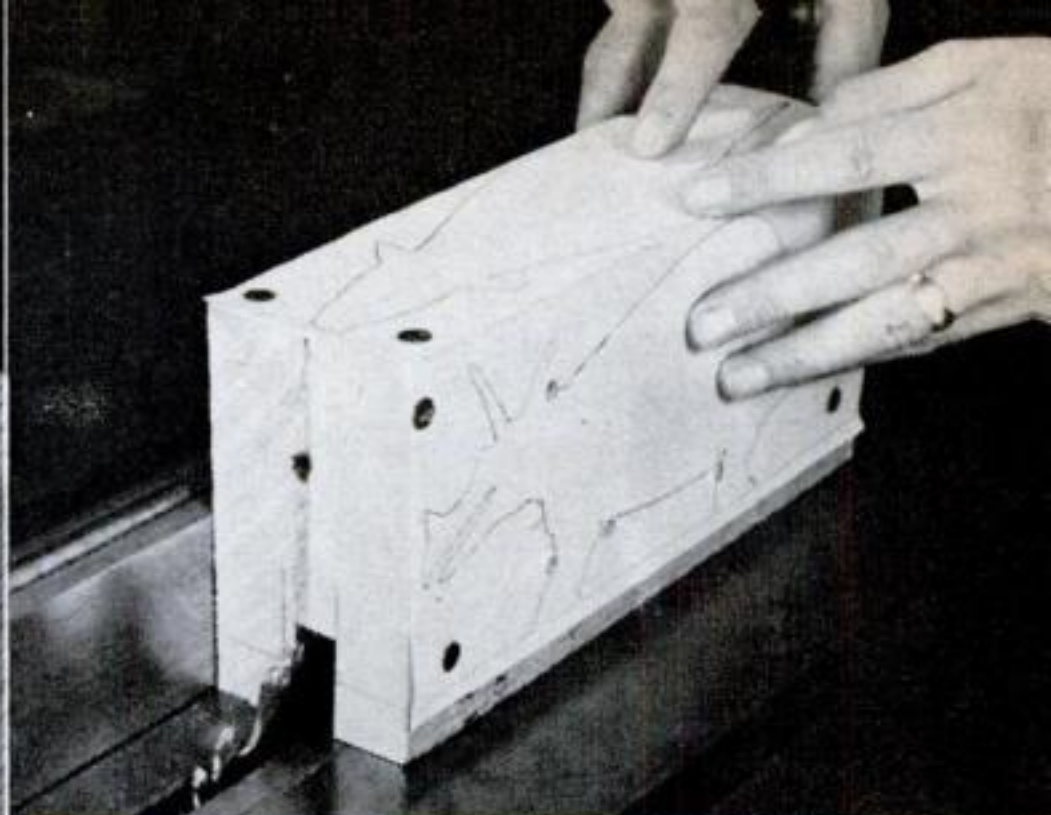
4 Cut the top profile first, working so the waste is removed in two pieces. Work slowly so the blade will cut without jamming. Lubricating the blade with beeswax helps.

finish. This is a pretty fine blade for a 5" or 6" cut, but you'll get good results if it's sharp and you don't jam it by forcing it or trying to cut too fast. Wider blades may be used, but they make it tough to get around small contours and tight radiuses.

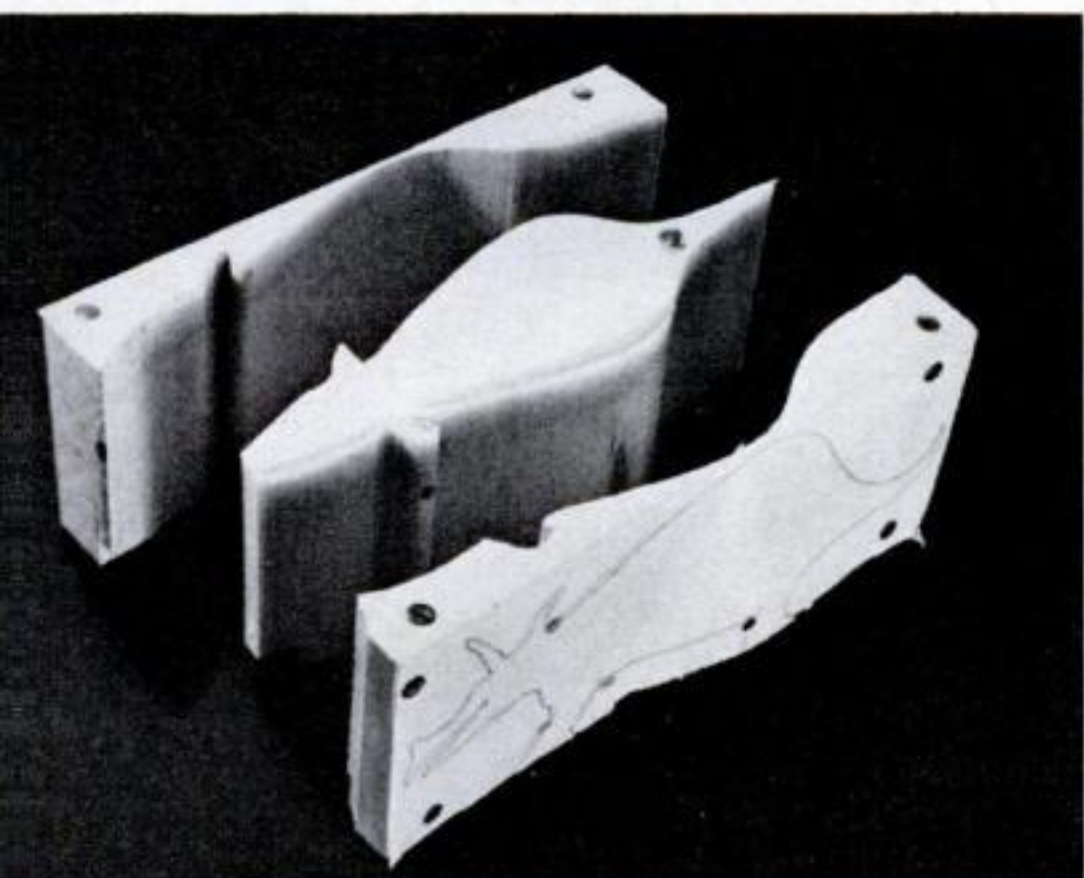
The secret is to cut away the top profile first, removing the waste in two pieces that can be easily nailed back in their original positions. Then, when you cut the side profile, it's like working on a solid block of wood again. In this final cutting, it isn't necessary to try to remove waste in large pieces.



2 Holes drilled at corners and tight turns make sawing easier. Top profile of a subject must be drawn around centerline and be aligned with side view. Keep top profile simple.

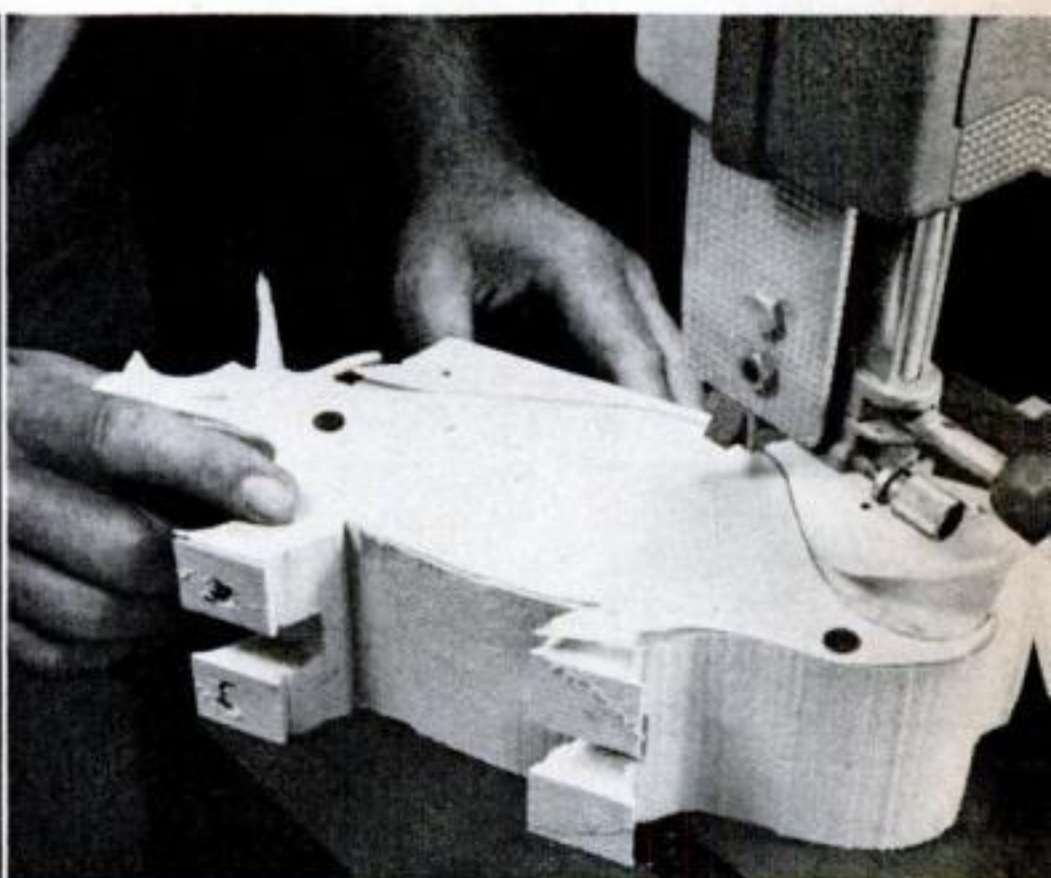


3 Precutting may help produce detail. Here, leg separation is achieved by making a dado cut down center of the block. Check height of blade against the side view of the drawing.



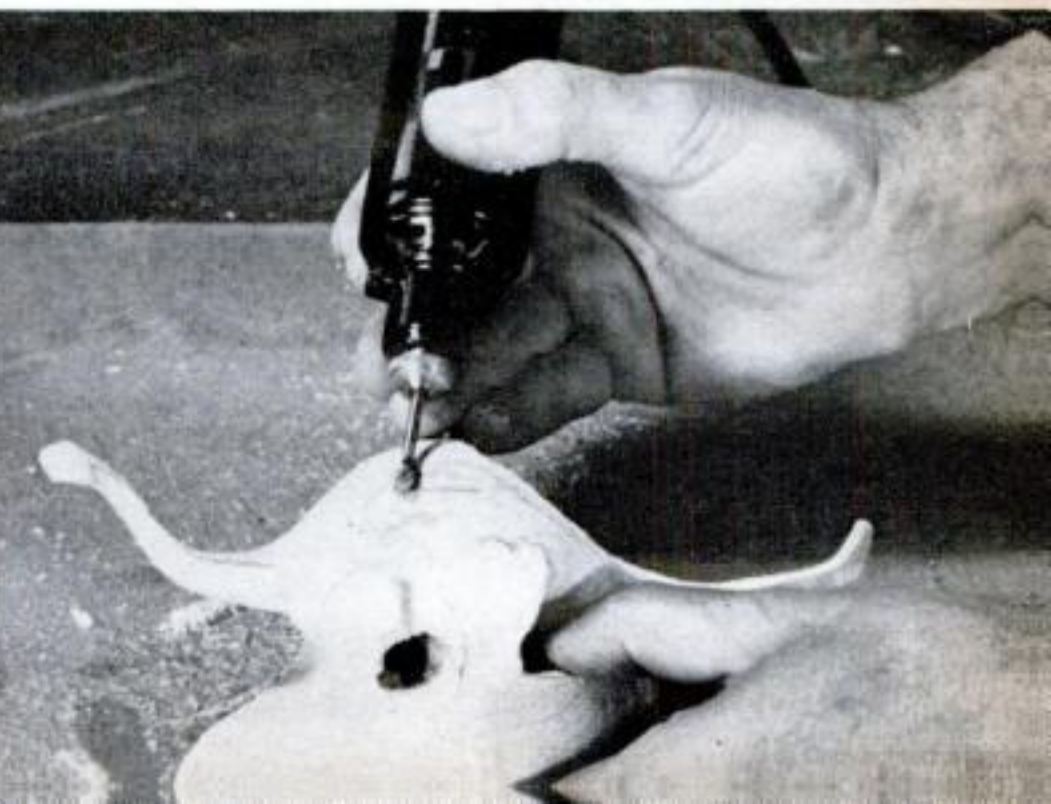
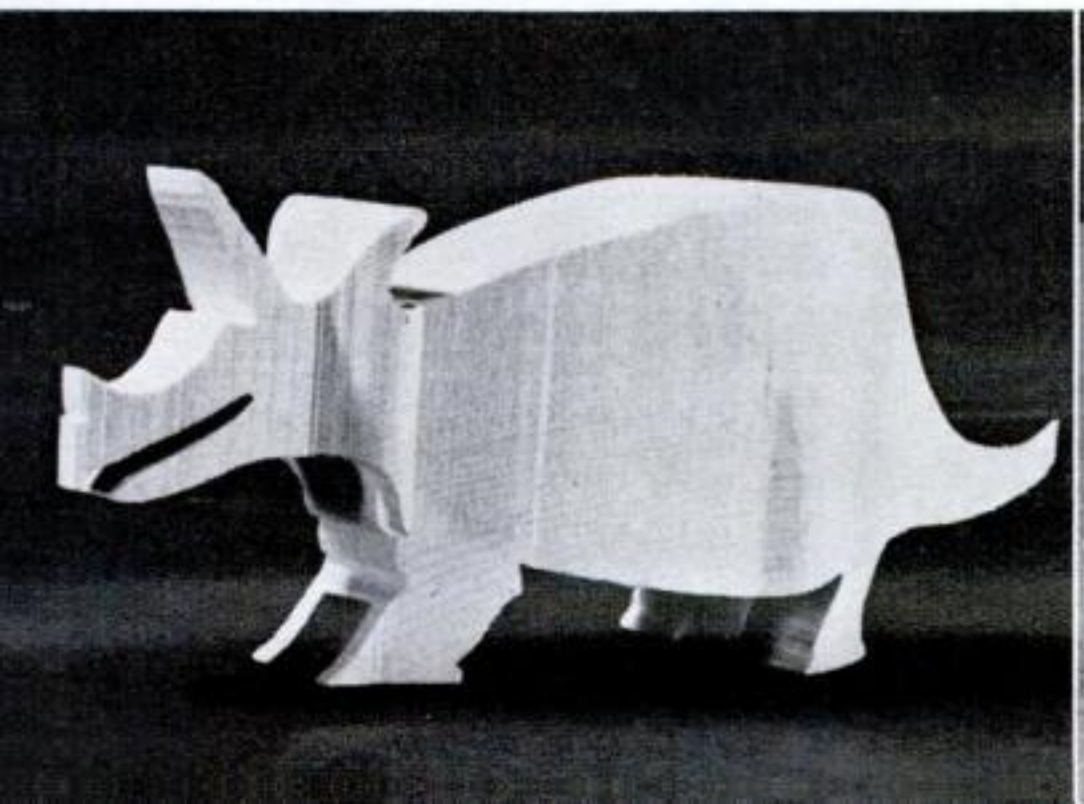
5 After top profile is cut, pieces look like this. Two outer pieces are attached to center block with nails through waste area. From here on, top pattern is no longer needed.

7 Sculptured figure looks like this after band-sawing. You can use sandpaper to round off the edges and to smooth cuts. The texture left by the bandsaw is effective on many figures.



6 Remainder of cutting is done with the re-assembled block placed on side. Cut away as much as possible without removing the nails that bind the sections together.

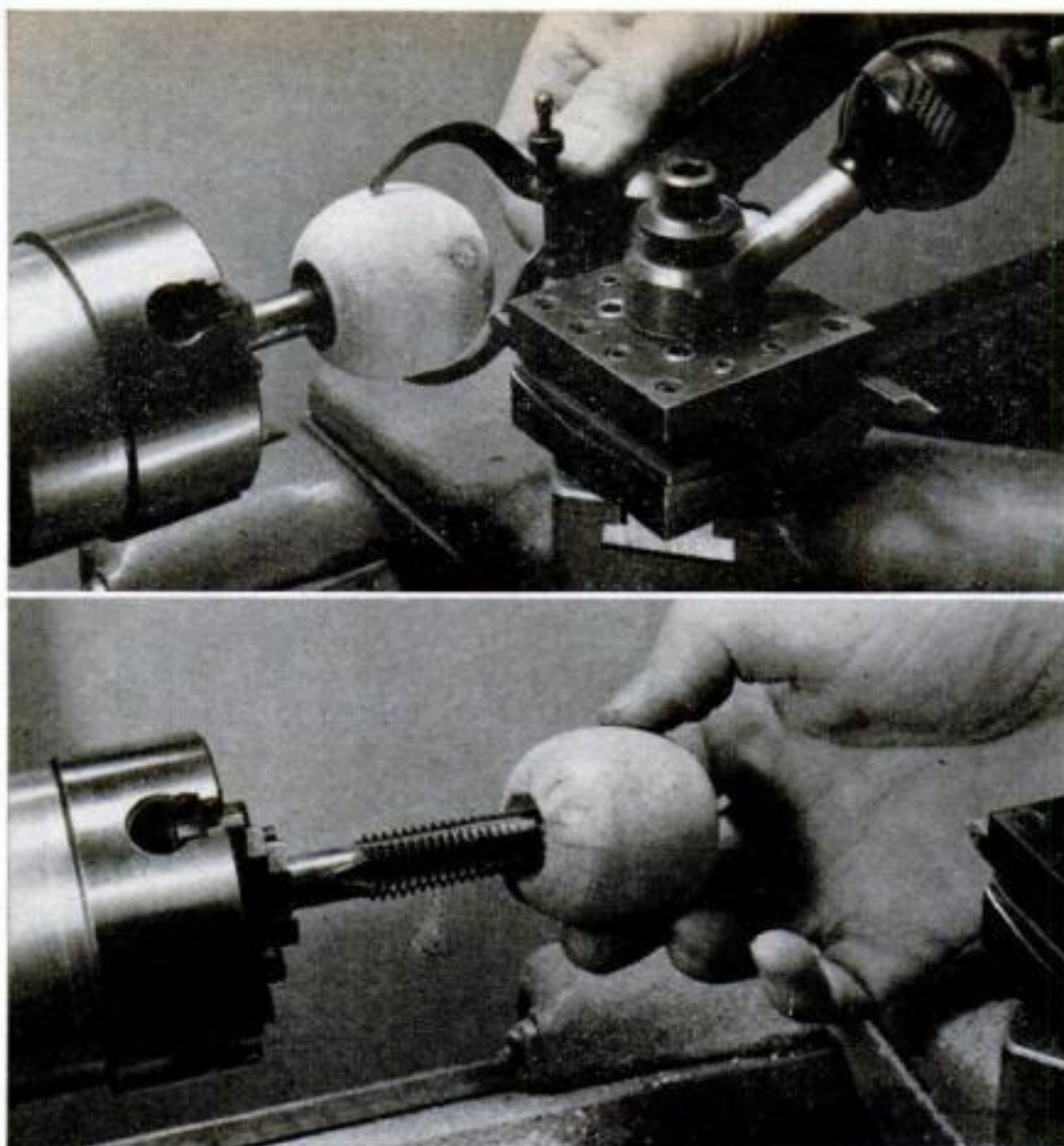
8 Realistic details can be added to the figure; a hand grinder with a rotary burr does a good, fast job. Smoothest cuts are obtained by moving burr to cut with grain. ■ ■



Tap in lathe chuck holds workpiece

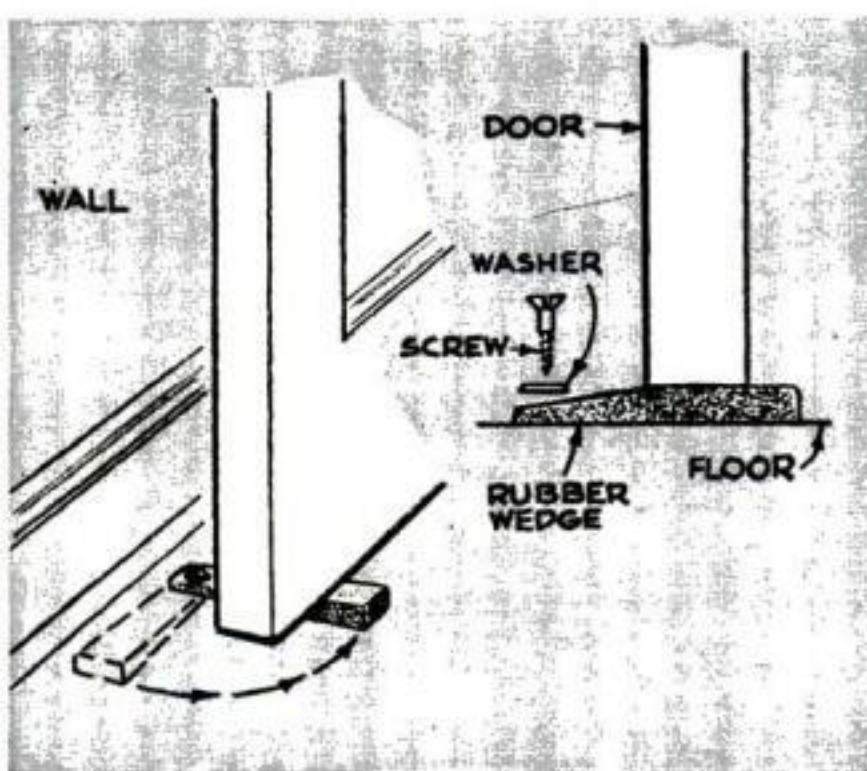
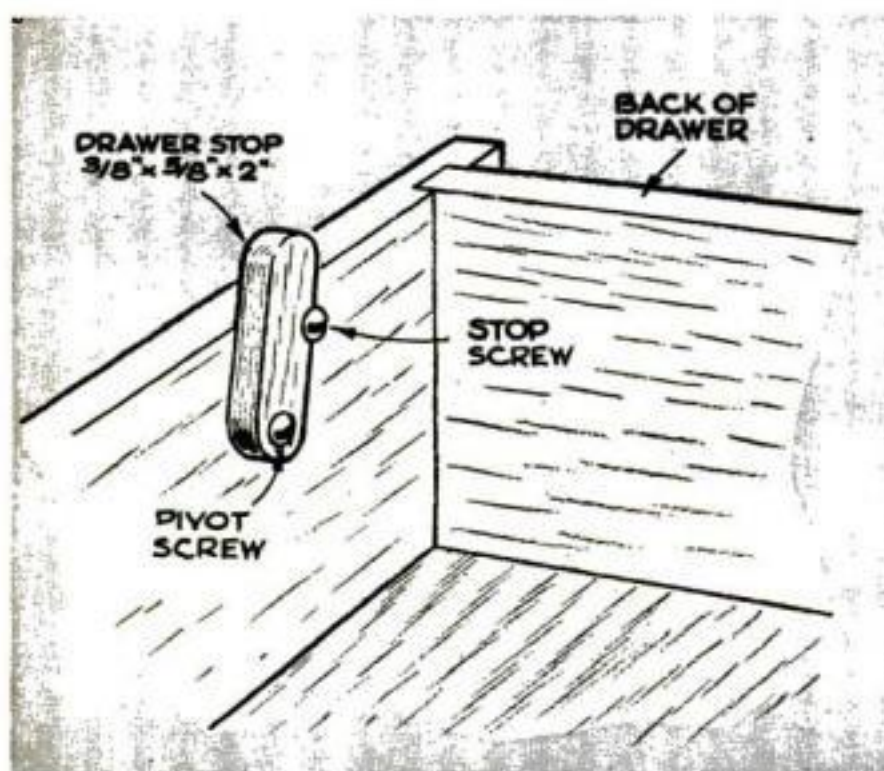
In turning down a wood ball, I found a threading tap made an excellent arbor. The tap was clamped in the lathe chuck, and the wooden ball, which had a hole through it, was simply screwed on the tap like a nut until it jammed. A tap can also serve as an arbor for a cylinder or other workpiece that has a central bore. The tap should be a bit larger than the bore and must run true in the lathe.

Photos show ball diameter being checked and the ball being removed from the arbor.
—Walter E. Burton, Akron.



►►►Our car is equipped with electric windows. To give complete control from the right front seat, I installed a switch on that side, in parallel with the switch to the driver's window. Now, my wife can use it

to open the driver's window. It's handy when I open her side and go around to my door. She can open my window, and I simply lift the plunger to unlock the door.
—W. C. Bellheimer, El Cajon, Calif.

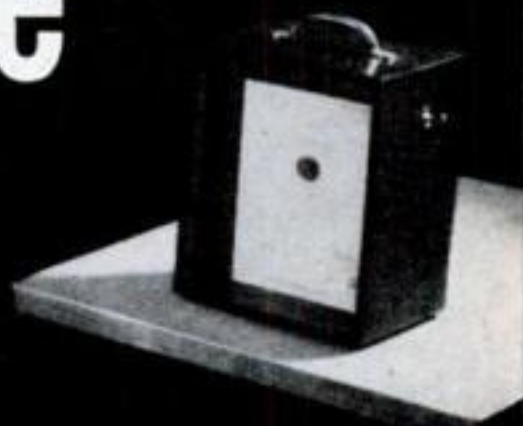
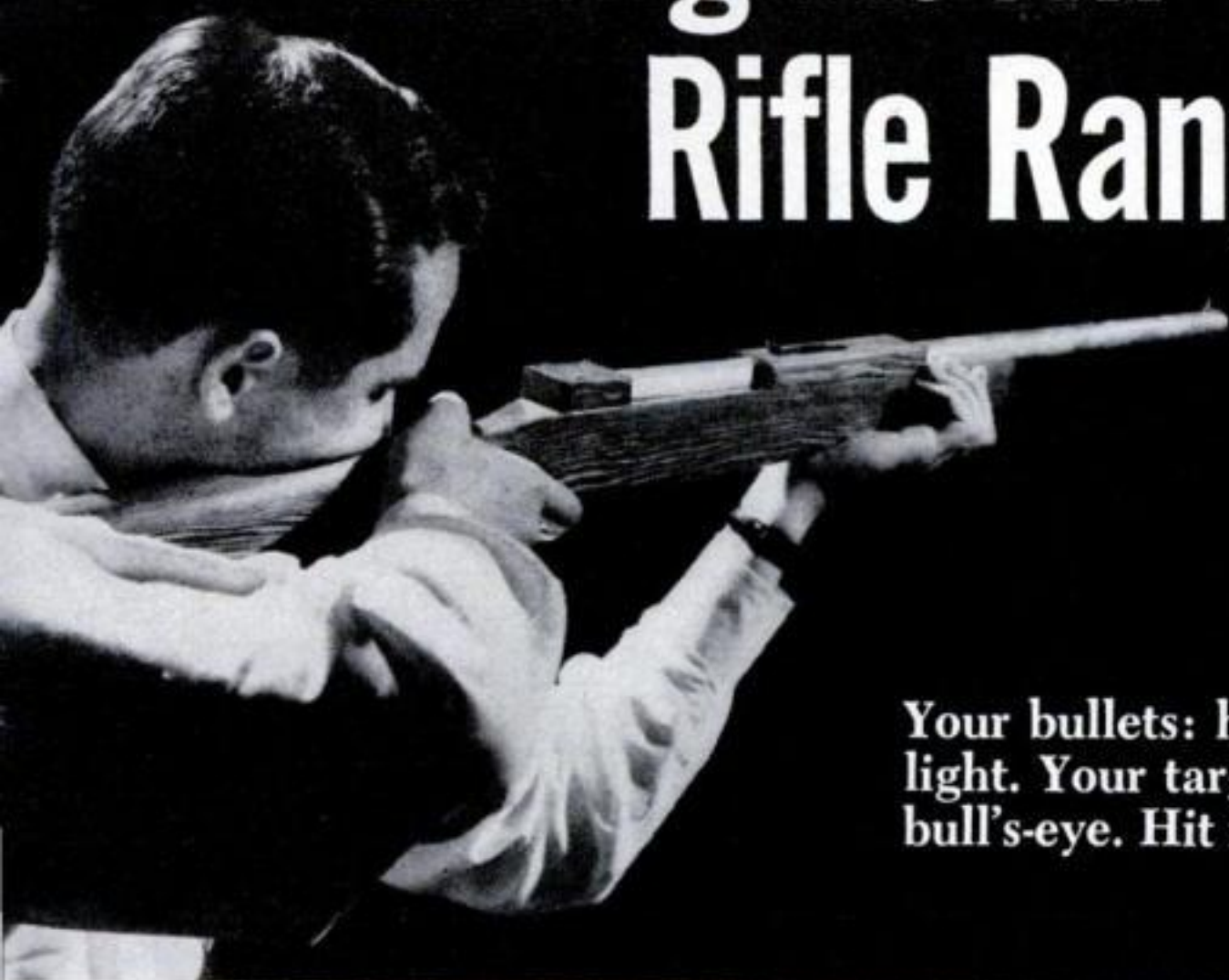


Two swiveling stops: one for a drawer, and one for a door

This drawer stop pivots out of the way easily when I want to remove the drawer. Normally, the stop remains upright, leaning against the screw. It avoids accidentally pulling the drawer out completely. But it's easy to turn when I need the drawer out.—
Frank Shore, NYC.

Here's a handy, nonstoop way to wedge open a door. I can swing the stop out of the way with my foot. When not in use, it stays put close against the wall. The wedge is an ordinary rubber one, available in any dime or local hardware store.—
Chester Fredericks, Chicago.

HOW TO MAKE A Living-Room Rifle Range



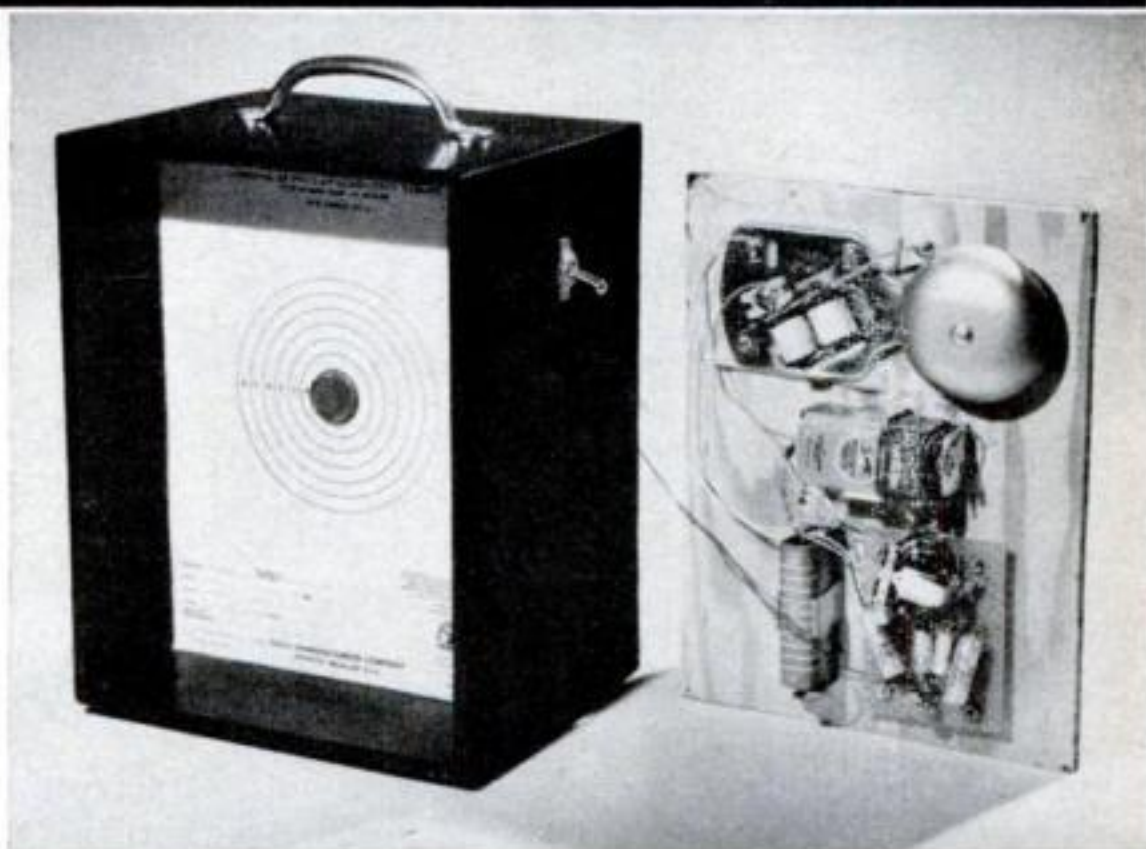
Your bullets: harmless flashes of light. Your target: a photocell bull's-eye. Hit it, and a bell rings

By Thomas W. Sikes

BUILD this rifle and photocell target, and you can sharpen your shooting eye right in your own living room. You fire harmless bursts of light at a cadmium sulfide photocell. A bell rings loudly when you score a bull's-eye.

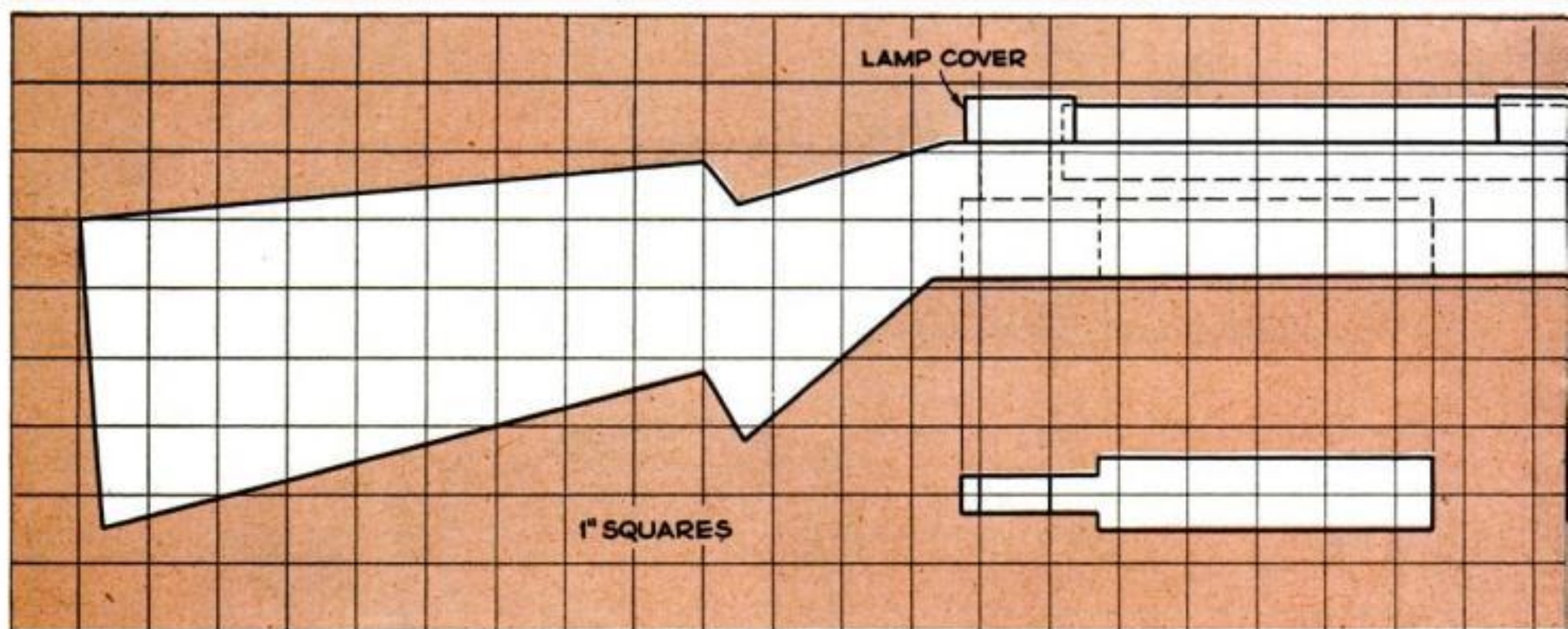
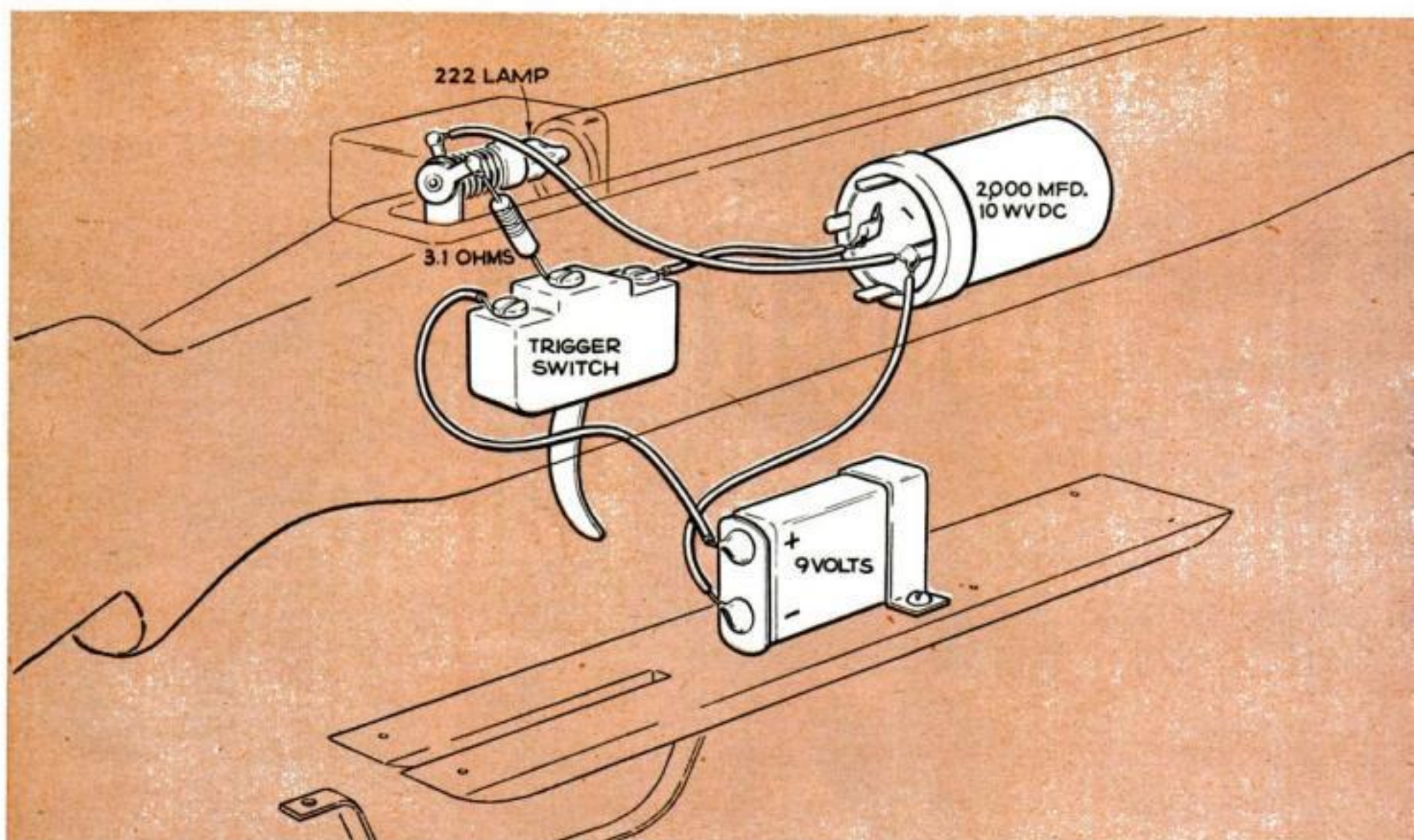
You can shape the gun stock easily from softwood, say a piece of two-by-six fir about 4' long. Or with a bit more effort you can use a hardwood such as walnut or maple. Choose wood that's free of tiny cracks and other imperfections.

Saw the stock to rough shape with a band- or saber-saw. Then cut the groove for



A light flashes in the gun when you pull the trigger. Two small lenses in the barrel focus the flash (if your aim is good) on a cadmium sulfide photocell—the bull's-eye in the target box (above). The increase of light on the photosensitive surface causes a decrease in the resistance of the cadmium sulfide cell, permitting more voltage from a 30-volt battery to operate a relay and connect a 6-volt battery to the gong. Target circuit and bell are mounted on back panel of cabinet.

CONTINUED



the barrel in the top edge of the stock, using a 1" fluting tool or a large round file. This half-round groove extends from the front end to a point just over the front of the trigger guard. A 1" rectangular groove chiseled to the rear holds the lamp.

Cut a 28" barrel from 1" aluminum conduit and check the fit in the stock. Saw out a 5" notch in the barrel for the lenses. Begin the cut about 6" from one end and make it $\frac{1}{2}$ " deep. Two No. 8 screws hold the barrel in place. Drill holes for these as close to the ends of the notch as possible so the screws will not interfere with the lenses.

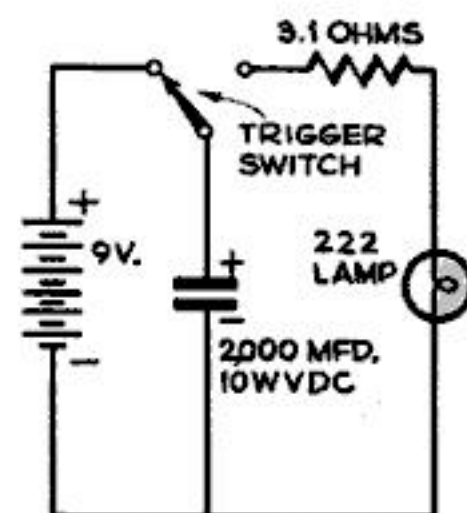
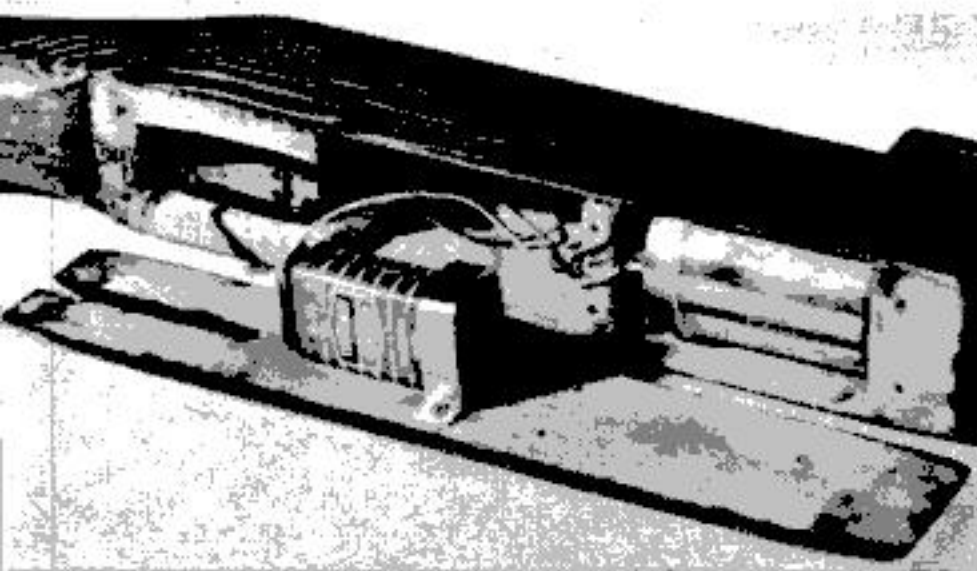
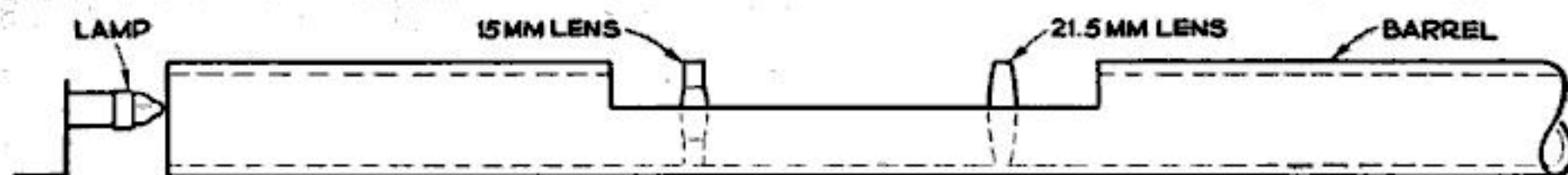
Next rout out the compartment for the trigger-circuit switch, battery, and capaci-

tor. If you don't have a routing bit, use wood bits and a chisel. The section of the hole nearest the pistol grip is $\frac{3}{4}$ " wide, $1\frac{1}{8}$ " deep, and 2" long. Drill a hole from this section to the square groove above so that the lamp socket can be passed up after the trigger circuit is wired. The remainder of the compartment is $1\frac{3}{8}$ " wide, $1\frac{1}{4}$ " deep, and $5\frac{1}{2}$ " long.

Before going any further on the stock, be sure the trigger microswitch and the 2,000-mfd. capacitor fit properly.

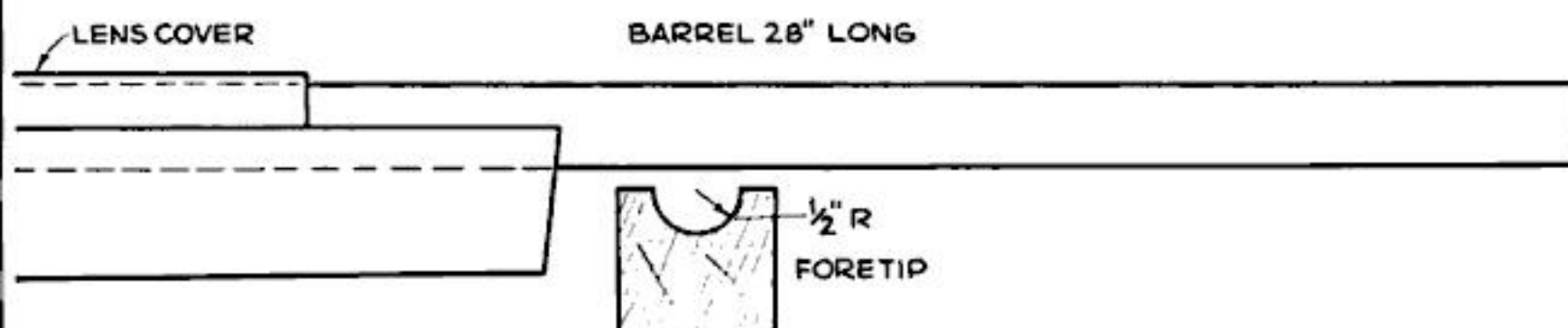
Now cut the stock to its final shape, using a rasp plane for rough shaping and a fine-tooth wood rasp for the details.

Make the lens cover and lamp cover from



Elements of the trigger circuit are housed in a recess cut in the lower part of the gun stock, as shown in the photo above. The lamp is located at the rear of the aluminum gun barrel (photo at

right). Careful testing and mounting of the lenses is required to assure accuracy in firing. (See text of article for how to do this.) To shape the gun stock, follow the pattern below.



wood left over when the stock was roughed out. Saw a piece $1\frac{1}{4}$ " wide by about 10" long. Then cut a $5\frac{1}{2}$ " length for the lens cover and a 2" length for the lamp cover. Drill a 1" hole the length of the long piece. Saw this piece in half on the $1\frac{1}{4}$ " side. Do the same with the lamp cover, but drill only deep enough to allow the cover to fit over the lamp and socket. Temporarily mount the barrel and lamp socket, and check the fit of the covers. Finish the covers to the shape you desire.

Saw a $\frac{1}{8}$ " strip and fit it over the trigger-circuit compartment. A $\frac{1}{8}$ " cut 2" long in this cover lets the trigger microswitch lever pass through.

Wire the trigger circuit, being careful to observe the correct polarity of the battery and capacitor. Screw a No. 222 lamp in the socket and test the circuit by operating the trigger switch.

With the trigger switch in the normal, nonoperative position, the 2,000-mfd. capacitor is charged from the 9-volt battery.

CONTINUED

PARTS LIST

TARGET

R1—12,000-ohm, $\frac{1}{2}$ -w. carbon resistor
R2—7,500-ohm, $\frac{1}{2}$ -w. carbon resistor
R3, R4—820-ohm, $\frac{1}{2}$ -w. carbon resistor
C1, C2—3-mfd., 25-v. electrolytic capacitor
C3, C4—150-mfd., 10-v. electrolytic capacitor
K1—6,000-ohm, 2.9 ma. Sigma relay, 11F6000 G SIL
SW1—Toggle switch, SPST

Cs1—Cadmium sulfide photocell Lafayette No. MS-895

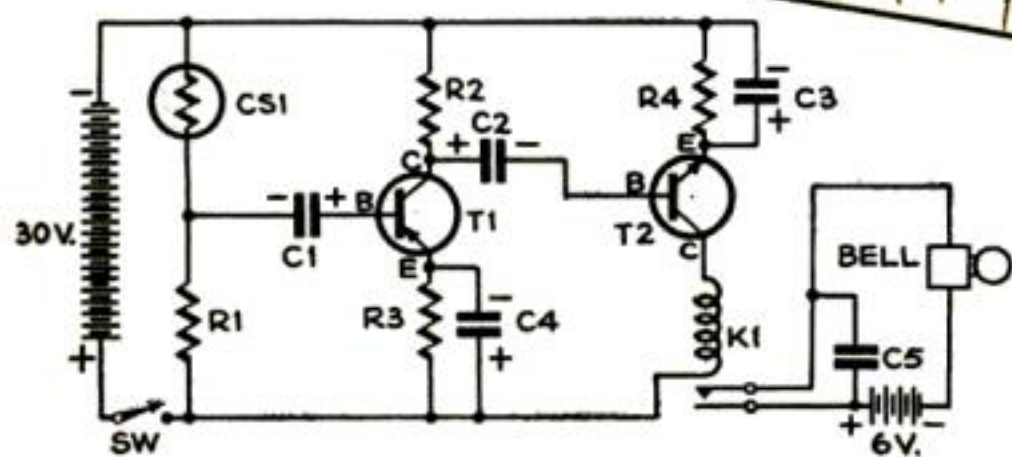
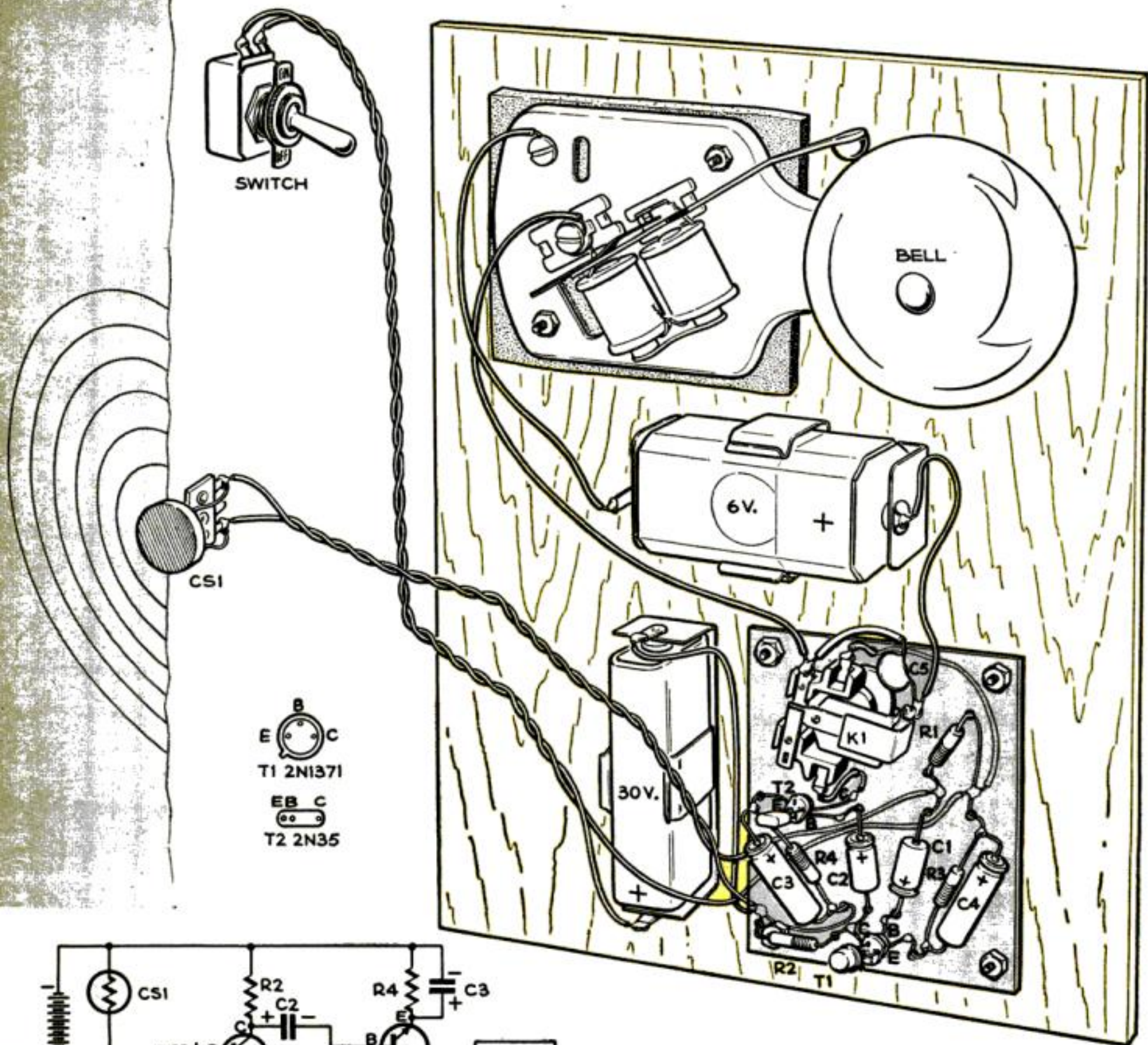
Q1—2N1371 transistor, PNP

Q2—2N35 transistor, NPN or equivalent

Misc.—30-v. battery, Eveready No. 413; 6-v. battery, Eveready No. 724; holder for each battery; 6-v. DC bell gong; two transistor sockets; terminal strip, 2 lug type; piece of perforated Vectorbord; scrap plywood for cabinet

RIFLE

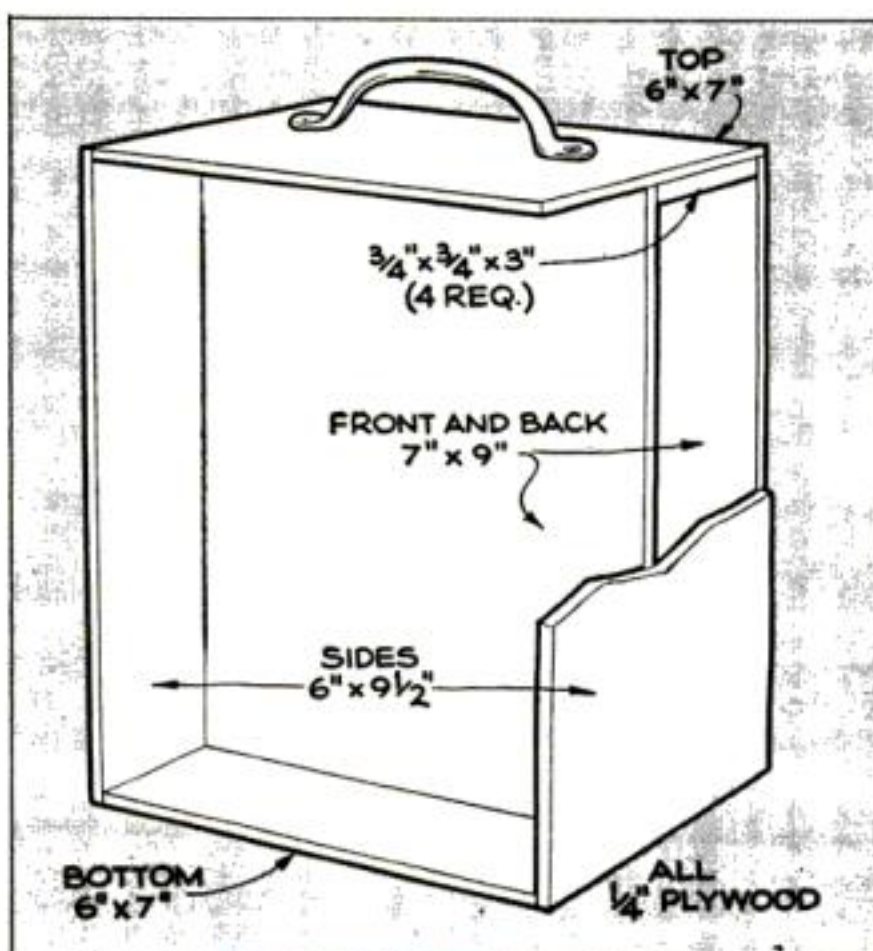
R1—3.2-ohm, 1-w. carbon resistor
C1—2,000-mfd., 15-v. electrolytic capacitor
L1—No. 222 pilot lamp
S1—Acro switch No. BRD2-5L-1S
Misc.—9-v. transistor battery and battery plug; miniature screw-type pilot-lamp socket; aluminum conduit (about 3'); 2-x-6 fir (about 3'); 15mm-diameter double-convex lens of 19mm focal length; 21.5mm double-convex lens of 75mm focal length

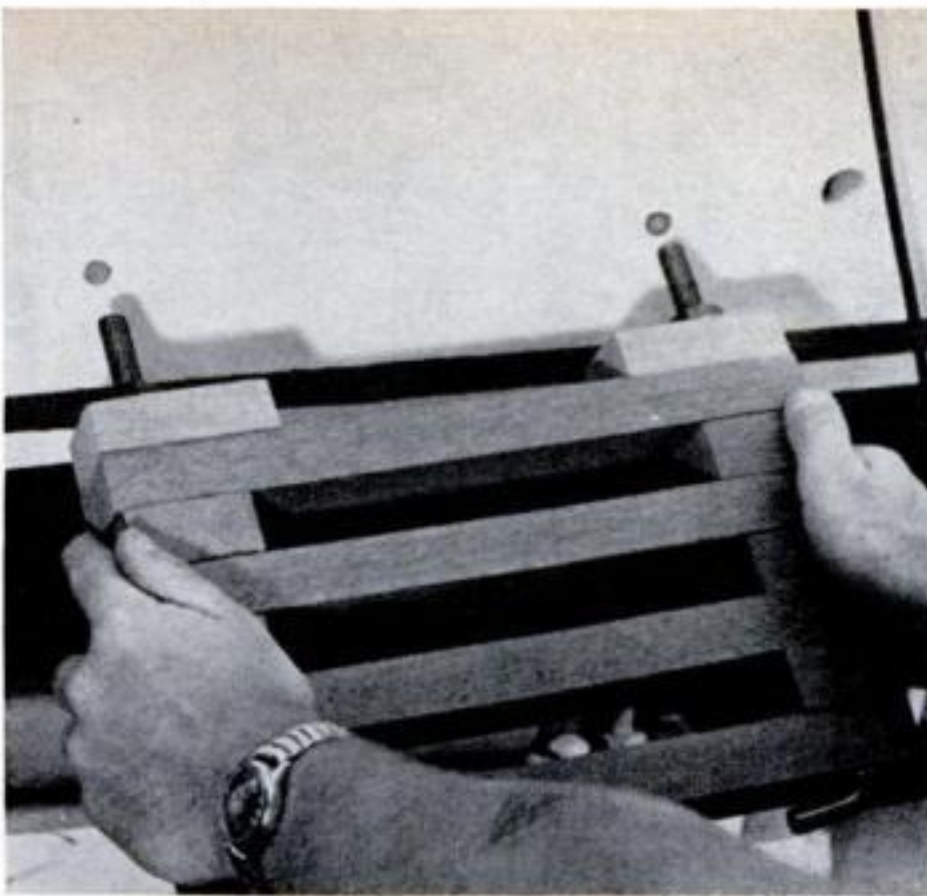


When the trigger switch is operated, or fired, the battery is disconnected and the capacitor connected to the lamp. The capacitor discharges through a 3.2-ohm resistor and lights the lamp.

Set up the lenses after the trigger circuit and barrel are installed. Cement the 15mm lens inside a 1" faucet washer, using PlioBond or epoxy cement. Wipe off any excess cement that may flow onto the lens. After this assembly is dry, clamp the rifle to a stable surface, such as a desk or table. Select a spot where you can sight at a wall

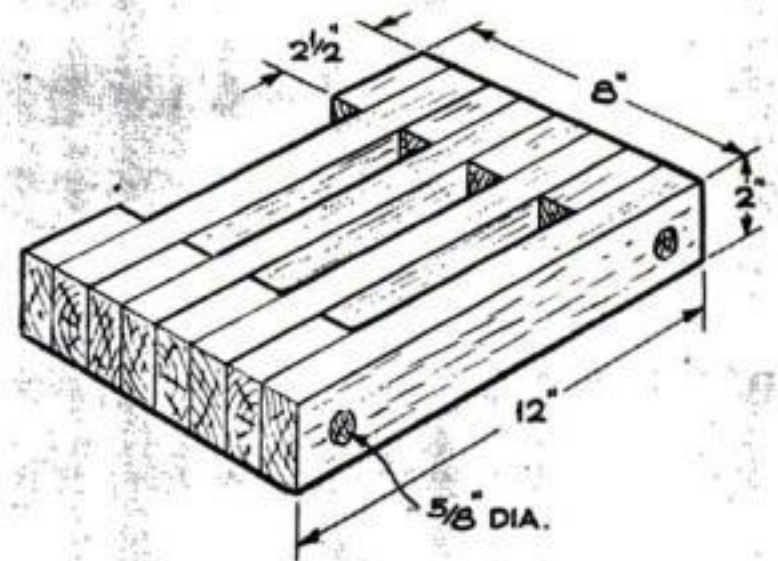
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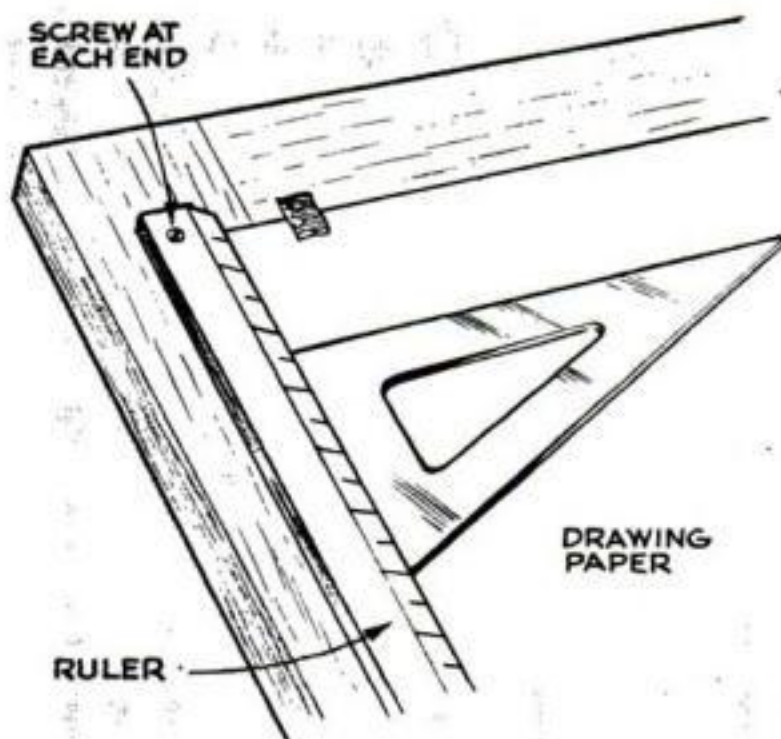


Easy-to-make swim step for a boat

Let the swimmers from your boat clamber back aboard on a handsome step like the one above. I used mahogany because it's a natural in water: It won't crack, chip, or peel. Buy the stock cut to size, making sure it is good clear grain, with no split



ends. Assemble the step as shown at right, stain, and apply three or more coats of varnish. If mounted on the transom at the waterline, the step will be 4" to 8" above water when the boat is moving. Be sure you attach the step where it won't interfere with your trailer tie-downs.—Victor W. Kondra, Temple City, Calif.



Using a ruler as a T square

For working on small diagrams, I find that a 12" or 18" ruler attached along one side of my drawing board enables me to use an easy-to-handle triangle instead of a clumsy T square. And the markings on the ruler come in handy for making measurements or drawing parallel lines. Either of the two standard triangles may be placed against the ruler, with the other triangle used to draw angles.—Frank Shore, NYC.



Make-it-yourself flexible disk sander

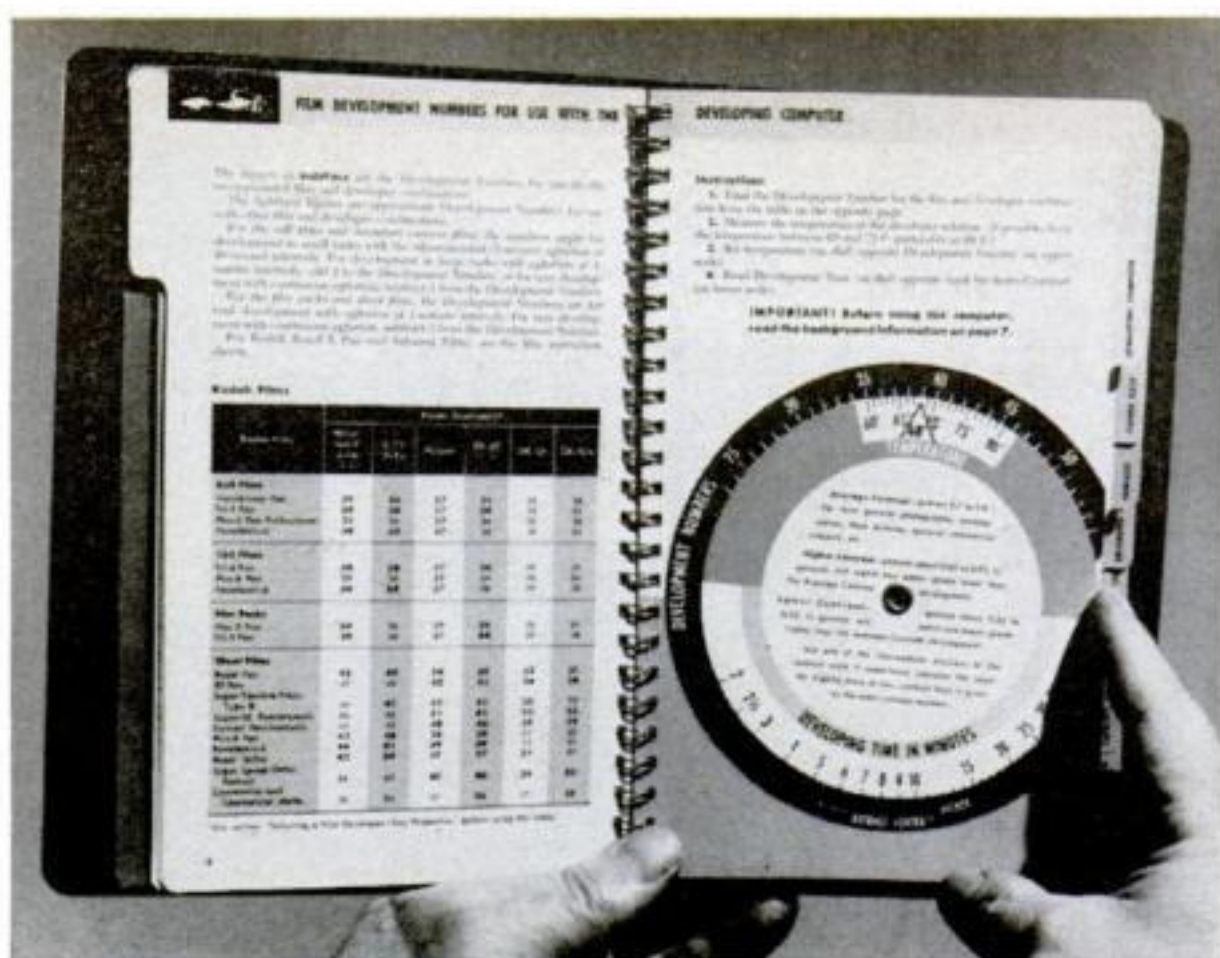
The valve-stem area from an old inner tube can make a small flexible sanding disk for your drill press or hand drill. Cut a circle of 2" to 2½" diameter around the stem. To make sure the stem is centered, first rough-cut a larger circle, chuck the stem in a drill, and rotate it while holding a pencil at the desired radius. Glue on an abrasive disk of the same size.—D. E. Burgderfer, Bend, Ore.

what's new PHOTOGRAPHY

New Dataguide— ready reference for the darkroom

Darkroom problem solvers get a boost with the third edition of Kodak's Master Darkroom Dataguide. Its 30 pages are packed with charts, tables, and hints. The inside cover is an 18-percent-gray card, for taking reflected-light readings with your exposure meter—especially useful for copying pictures or charts. A disk-type computer makes it easy to figure developing time for different film-and-developer combinations—you can more consistently choose the contrast you want. Combinations other than Kodak's take figuring.

A second calculator is actually two dials back to back. With one, you can determine the new exposure time when changing lens aperture or picture size. The other gives density readings. Use both together, and you can choose the correct exposure time



and right grade paper for any negative.

In the film section, there's data on exposure corrections for close-ups and time exposures longer than one second, and information on selecting film developers.

The paper section gives hints on selecting paper grades and surfaces, and computing exposures. The book also includes information on toners and safelights.

The section on chemical preparations has data on the keeping properties and capacities of solutions, proper replenishment and fixation, tests for hypo, and conversion tables. Price: \$2.95.



Zeiss camera has oversize viewfinder

The moderate-price Contina 35mm camera has a large, bright viewfinder with a dotted-line frame for composing pictures. Parallax markers make it easier to frame a subject accurately at close ranges. For extreme close-ups, the Contameter rangefinder attachment can be used. \$54. Carl Zeiss, Inc., NYC.



Light meter with reading light

The Bewi CdS light meter takes a wide range of readings on a single scale—no need to change from high to low range. Lamp on chain is reading light, \$49.50. Burleigh Brooks, Englewood, N.J.

NOW, from our Accident Division you get:

\$1,000 cash a month

even for the rest of your life while hospitalized from any accident.

No, this is not a misprint. You get an iron-clad guarantee which pays you at the rate of \$1,000.00 CASH a month beginning the first day you are in a hospital (other than a sanitarium, rest home or government hospital) from any accident. Even if you're so confined only one day, you still get \$33.33.

There are no gimmicks. There are No Exceptions, No Exclusions, No Limitations, no waiting periods, no ifs, ands or buts.

And what's more - - -

This plan is NON-CANCELLABLE and GUARANTEED RENEWABLE for Life.

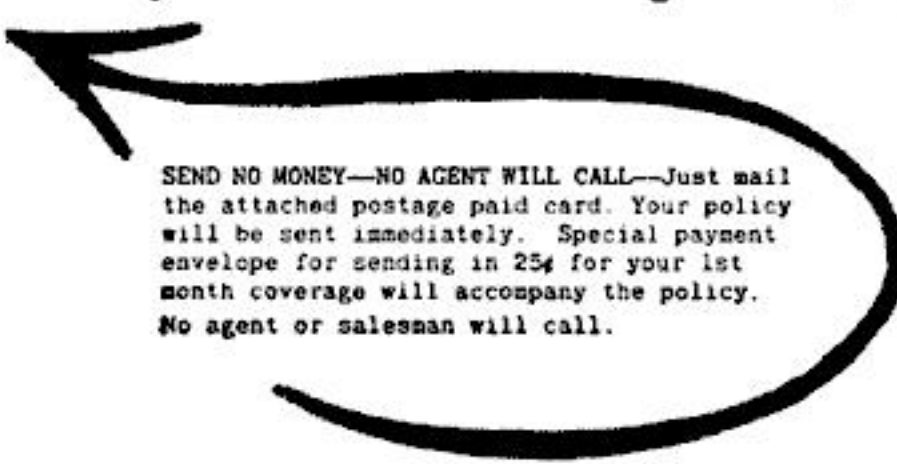
1. Use your policy as often as you need to—you own it, it can never be taken away as long as you pay your premium on time. Your premium can never be raised; your benefits can never be reduced.
2. You are paid even though you have other insurance or compensation. You get CASH . . . use it for any purpose: pay bills, buy groceries, pay rent, etc. When you are hospitalized your everyday living expenses still go on. Help meet them with the TAX FREE cash this policy provides.
3. THIS PLAN PAYS CASH WHILE YOU ARE HOSPITALIZED FOR ANY ACCIDENT, ANYWHERE, ANYTIME, TWENTY-FOUR HOURS A DAY. You DON'T have to be hurt in any particular kind of accident such as: Auto, Pedestrian, Bus, Traffic, Train, etc. ALL Accidents are covered.

You get a full month's coverage for 25¢. Send no money. When you receive your policy, read it carefully. Only after you agree it does everything we claim, send in your quarter. This doesn't even cover our cost, but we'll gamble that you will continue at the low price of only \$5.00 a month - - - just as thousands of others have done. Remember for each day you are in the hospital, you get \$33.33.

How can this policy be offered at such a low cost? The answer is simple. You are buying directly from the company through the mail and the savings are passed on to you. No agent or salesman will call or bother you.

Compare this with others. We welcome comparison because this policy pays from the first day, we can't pay any sooner; it pays forever, we can't pay any longer. Policy issued ages 1 through 80 to residents of the United States who can qualify.

Don't wait until it's too late. Fill out the application and mail it today. There are no strings attached; you are under no obligation.



SEND NO MONEY—NO AGENT WILL CALL—Just mail the attached postage paid card. Your policy will be sent immediately. Special payment envelope for sending in 25¢ for your 1st month coverage will accompany the policy. No agent or salesman will call.

Sincerely yours,

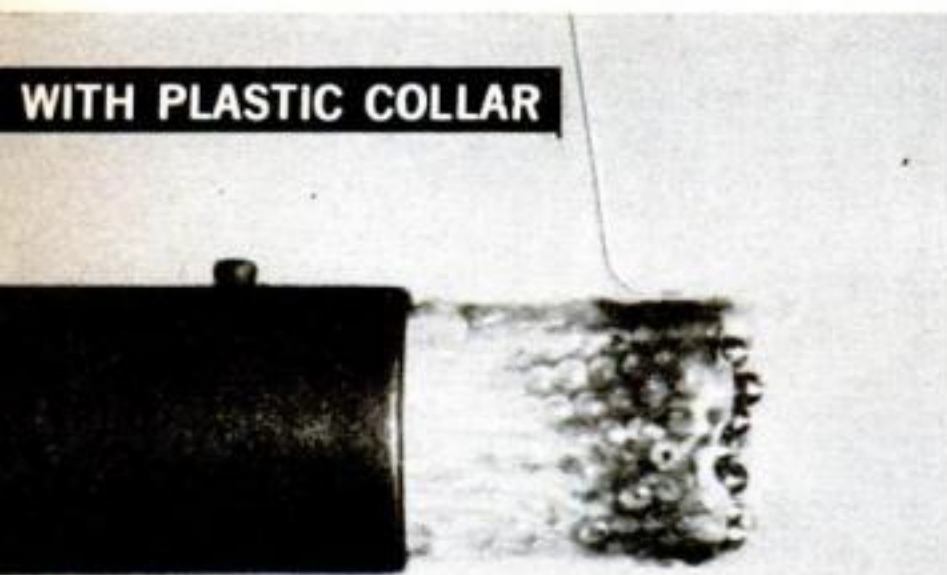


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330 S. Wells Street
Chicago 6, Illinois

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How a plastic wrapper keeps your shot right on target



WITH PLASTIC COLLAR

Blast from new shotshell leaves muzzle fully enclosed by protective polyethylene collar.

Blast from conventional shotshell shows how pellets are scraped flat by barrel abrasion.



At 18" from muzzle: Plastic collar starts to peel off, leaving pellets in a compact group.

At 18": Collarless pellets start to scatter, and to stretch out in a longer string.



WITHOUT PLASTIC COLLAR



They take the scatter out of scatter guns:

New Shotshells Turn Misses into Hits

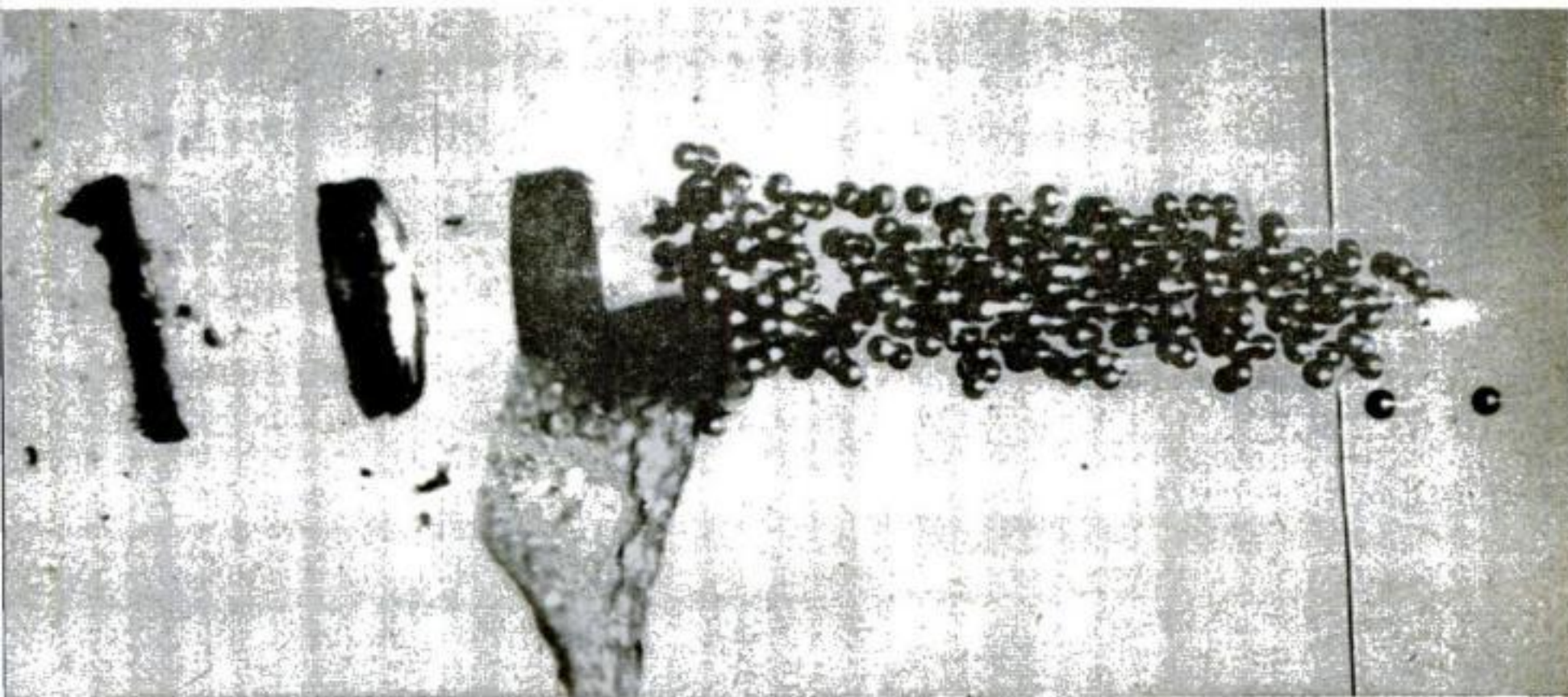
By Sid Latham

LIKE to bag the limit the next time you go hunting, or up your score on the trap range? A tiny plastic wrapper inside a new kind of shotgun shell may help you do just that. It's all it takes to make the difference between a tight shot pattern that hits squarely on target and one that spreads out like a homeward-bound movie crowd

on a Saturday night. The result: more hits.

Plastic-wrapped shot is the brain-child of Winchester-Western, and the new shells go by the name of Mark 5. The shot pellets are wrapped with a clear, pliable, polyethylene collar that slips between the shot and the shell's paper tube. The plastic acts like a lubricating buffer to protect the pellets from abrasion as they travel down the barrel.

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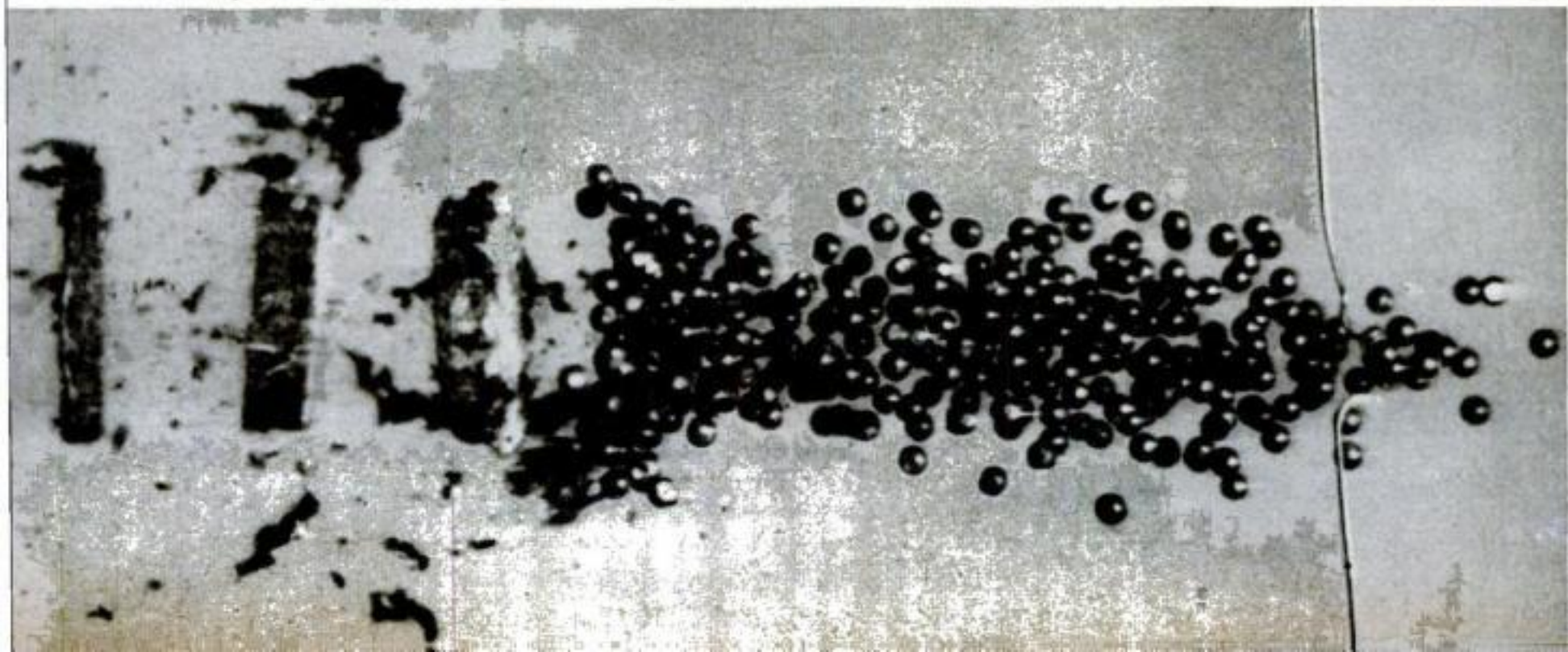


At 36" from muzzle: Collar comes off, but pellets stay tightly grouped, aren't strung out

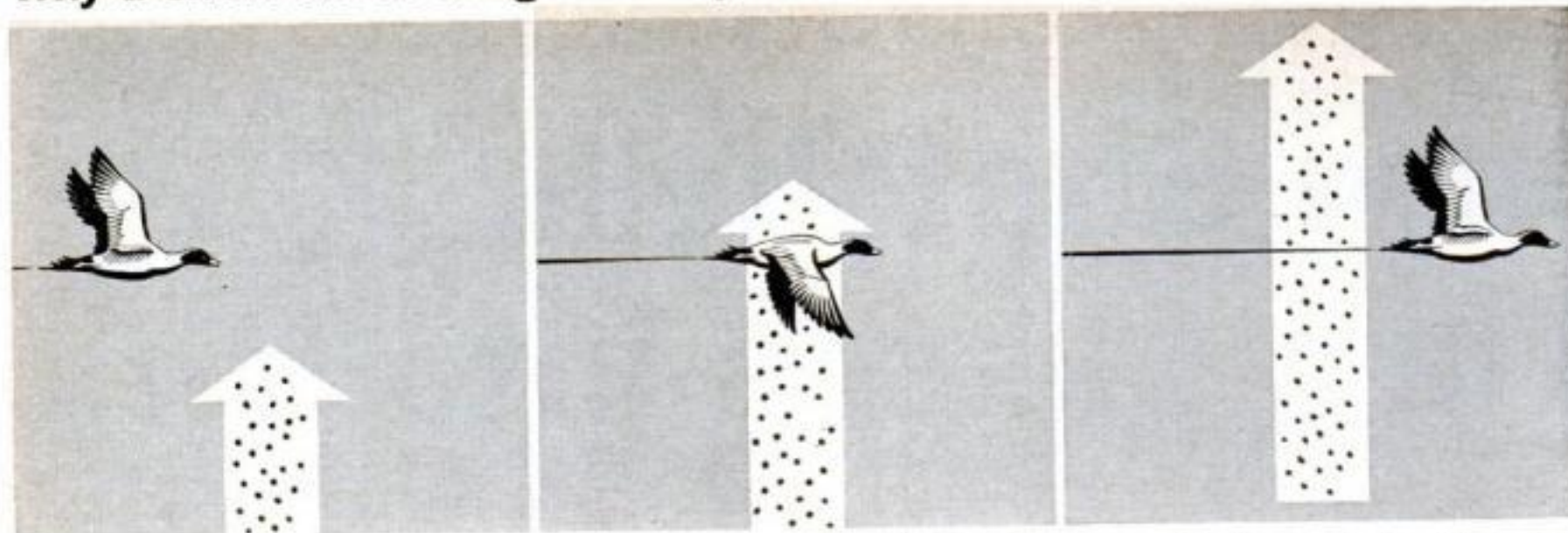
like those below. Photos were made by firing at a trip wire to snap shutter automatically.

At 36": Pronounced scatter shows up. Note how unevenly shaped pellets go skittering off from

the main group. Strung-out shot means that fewer hit any one spot, as shown on next page.

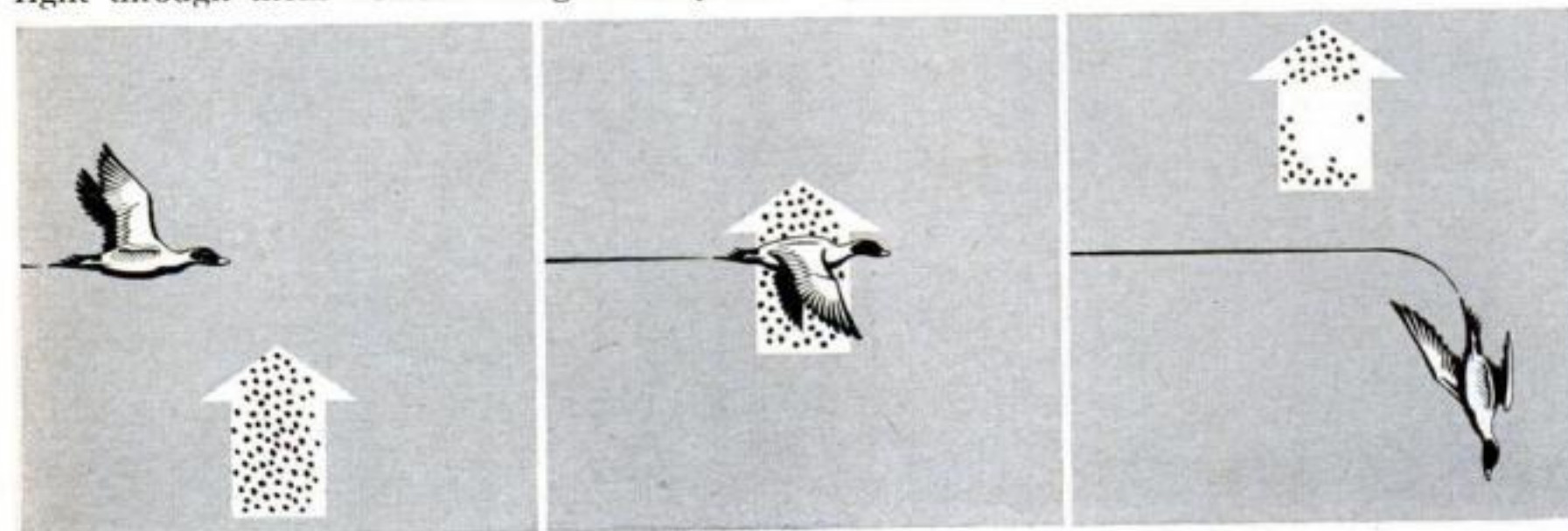


Why a short shot string means you're more likely to get a hit



Good aim can be spoiled by a long shot string, as shown in sequence above. If pellets are strung out in a long row, a fast bird can fly right through them without being severely in-

jured. In the new Mark 5 shells, the shot string is kept tightly bunched, as shown in sequence below. If aim is right, target is struck by full blast of shot, knocking it down.



In a conventional shotshell, abrasion skins lead from the outer layer of pellets. This distorts the shot, and air currents soon batter the flattened pellets out of their flight path, skittering them off like paper pie plates in a stiff wind. But the plastic-wrapped pellets, protected from abrasion, are held in a tightly packed group and stay on course.

Do the Mark 5s really work?

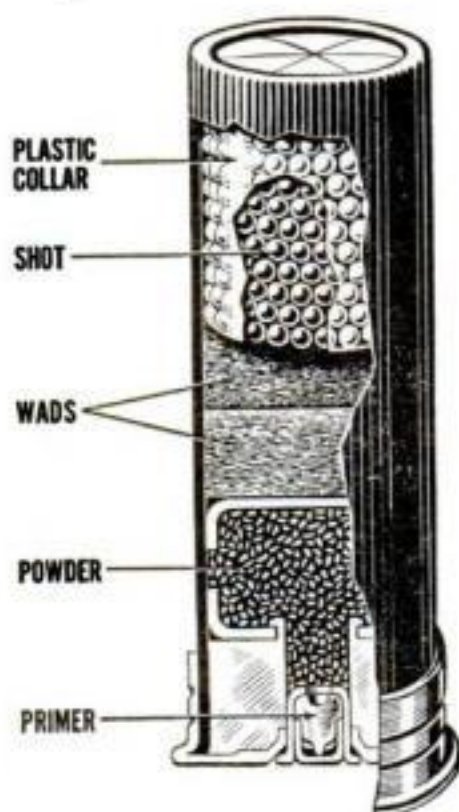
The Number One marksman and six more of the top 10 winners at the 1962 Grand American Handicap in Vandalia, Ohio, used Mark 5 shells. Since this event is the World Series of the shooting world, it's good evidence that the plastic wrappers are doing their stuff.

The new shotshells are an aid to all types of hunters and trap shooters because the lack of pellet abrasion keeps the shot flying true and the pattern more dense. But they also have a special advantage for duck

hunters. Their "shot string"—the distance that the shot is strung out in flight from the first, leading pellets to the last, trailing ones—is about 10 percent shorter than conventional shotshell strings.

A fast-moving bird can fly right through a long string of shot and only get nicked because the pellets are spread out. But the shorter shot string of the Mark 5s means the pellets are concentrated more closely together to make a hit more likely. The tight shot pattern also makes for clean humane kills with fewer cripples. States that now forbid the use of buckshot for deer hunting, in order to avoid cripples, may even be induced to change their laws in light of the new shells' ability to kill more cleanly.

The new Mark 5s are available in standard gauges from 12 to 20 and in various types of buckshot, birdshot, and trap and skeet loads. ■ ■



Cutaway sketch of new Mark 5 shell shows how plastic collar surrounds the shot at top.

PHOTOGRAPHICALLY SPEAKING

By Bob Hering PS PHOTO EDITOR



Coming up: electronic cameras and automatic focusing

Electronics may revolutionize camera operation as swiftly as the photoelectric cell did when it started automation.

In June, we reported the excitement stirred up by Canon's new autofocus 35mm camera at this year's big German Photokina. The camera displayed was only a prototype.



The principle of electronic automatic focusing is not entirely new. Zeiss has been using electronic auto focusing for over two years to do lens testing. Its tester focuses within a split second by locating the point of maximum contrast on a grating of black and white lines.

Up to now even the so-called fully automatic cameras required manual focusing unless you were shooting with a simple fixed-focus camera. Now if the Canon works as it's said to do, it will eliminate one of the last manual operations left to the photographer.

Detailed technical data has not been given out; but there are some things we do know.

The Canon autofocus mechanism includes two diodes, seven transistors, two micro-motors, and two relays. Both the focusing and taking lens are mounted together. When the shutter release is pressed, the micro-motor shifts the lensboard with both lenses. Beside the Canon 40mm f/2.8 taking lens, there's a relatively long 75mm f/2 mirror-type focusing lens of four elements.

Light reflected from the subject is measured by the focusing assembly through a mirror-optical (catadioptric) system, which both reflects and admits light. The view seen by the focusing lens appears as a rectangle in the center of the viewfinder.

As the moving focusing system passes the point of highest subject contrast (maximum sharpness), it sends a peak pulse. The circuit amplifies this pulse until it's strong enough to actuate the switch and stop the micro-motor. The entire focusing operation takes only a second.

Electronic shutters. There's been a lot of research on electronically operated shutters for small cameras. Getting them to fit small cameras was a nice problem in miniaturization. Two Japanese companies, Yamato and Copal, have produced prototype electronic shutters.

Big advantage of the electronic shutter system: Control range is considerably greater than that of conventional automatic cameras. It even reads flashbulb illumination during exposure.

All of these systems use highly sensitive photoresistor cells to register light values. The amount of current getting through the cell depends on the light reaching it. When the light is bright, the resistance is low. When it is dim, resistance is high.

The Yamato Camera Company has made prototype models of both

PHOTOGRAPHICALLY SPEAKING

movie and still cameras that use their new Artronic shutters. It will soon be possible to have a movie camera with a shutter as variable as a still camera. In the Artronic system, shutter speeds extend over a wide continuous range. For stills, the controls are made to fit either focal-plane or leaf-type shutters.

When you press the shutter release of an Artronic still camera, the circuit feeds a weak pulse to the photoresistor cell and a stronger one to a detector. The pulse getting through the photoresistor is compared with the stronger pulse to the detector to regulate the closing of a relay, which in turn closes the shutter.

The movie shutter has a photoresistor cell and generator built into the system. Its unique feature: It automatically adjusts both aperture and shutter speeds.

The shutter consists of two disks: one of aluminum with silver-coated printed circuit that functions as a coil; the other, a conventional shutter disk. The disks rotate simultaneously; the aluminum disk, moving between magnets, generates current. A photocell supplies resistance.

In bright light, the resistance is low, braking the magnets and slowing the aluminum shutter disk to reduce the opening. In dim light, the disk is speeded up to catch up with the other disk and enlarge the opening.

One shutter, the Copal, uses a photoresistor cell and condenser to set exposure speed. The amount of current getting through the cell controls the charging rate of the condenser. When the charge reaches a given level, excess current closes the shutter.

In bright sunlight, with low resistance, the condenser charges more rapidly. In dim light, it takes longer to charge the condenser, which delays the closing of the shutter.

The Canon autofocus camera and the Copal and Yamato shutters are still in the testing stage, but next month I'll report in depth on a

new electronically controlled camera now being made by Polaroid. Its shutter operates by a combination of mechanical and electronic means.



Zeiss lens checker focuses electronically.

International color competition

Eastman Kodak is sponsoring an international color competition open to both amateur and professional photographers.

Their aim: to search out, for display at the New York World's Fair in 1964-65, outstanding color transparencies and prints taken with Kodak material.

Entries must be either Kodachrome or Ektachrome transparencies or Kodacolor or Ektacolor prints. Exposures may have been made at any time. The theme: the world and its people. Subjects may include people; scenes and architecture; sports, hobbies, or what have you.

A World's Fair bronze medal and certificate will be given for each entry accepted. For the 300 winning photographs, a silver medal and \$100 will be awarded. Entry forms, available from any Kodak dealer, must accompany all pictures.



Dualmatic 50—

Shoots 50
feet of film without
rethreading



A man-size knob on the side winds the spring drive for 35 seconds of continuous shooting, and there's a trigger-type shutter release just beneath the lens. One fast movement rotates the film chamber at the rear 180 degrees (right) to expose the other 8mm half-width of the film.

By Bob Hering

LOOKING for an inexpensive 8mm movie camera with simplified automatic controls? Then the compact Dualmatic 50 should interest you. You can load it with regular 8mm roll film, run off the first 25 feet and flip the chamber to shoot the second 25-foot 8mm width. There's less chance of missed scenes or light-struck film.

The camera uses the new supersensitive CdS exposure system, automatically measures the light, and sets the correct exposure. Most of us leave such cameras on automatic control, but you can instantly change to manual control on the Dualmatic by moving a knurled selector knob.

This is useful in difficult lighting situa-

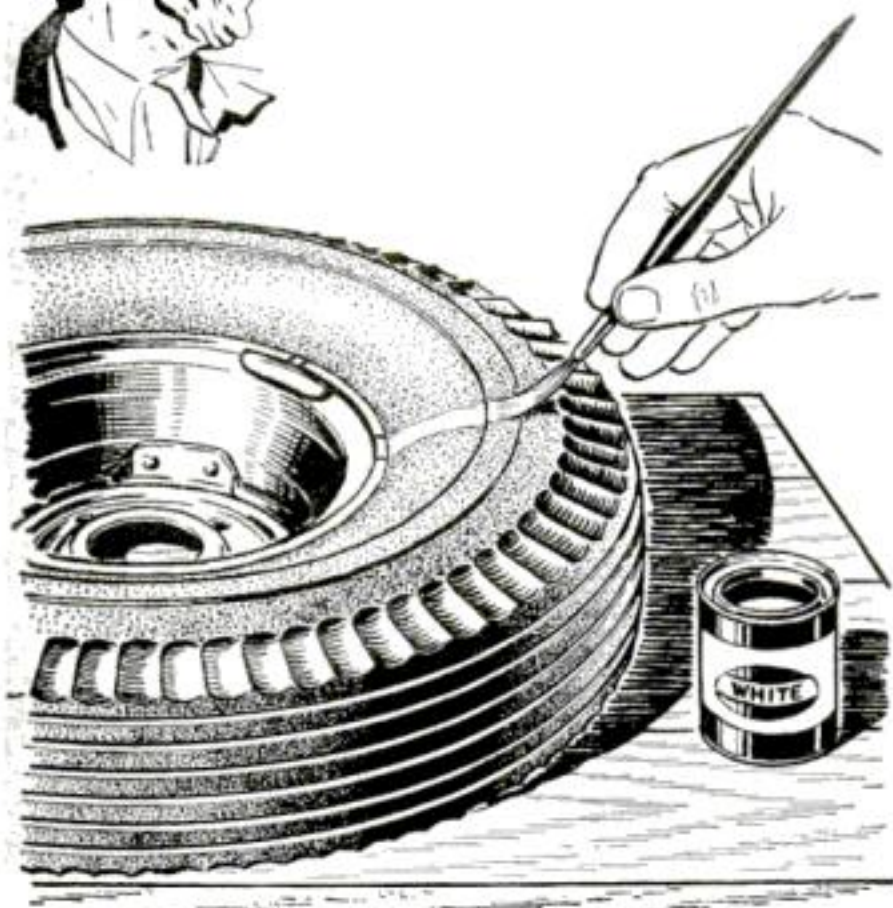
tions—backlighting a subject, for example. You can move in close, note the reading, and move the selector knob until the manual-control needle points to the new f/number. Then you back off and shoot. Since the reading is taken off the subject, the backlighting doesn't fool the meter.

The single-frame feature lets you do animation work and get special effects. You can make title letters pop up and objects come to life. The fast f/1.8 Rosonar fixed-focus lens has a built-in type-A filter.

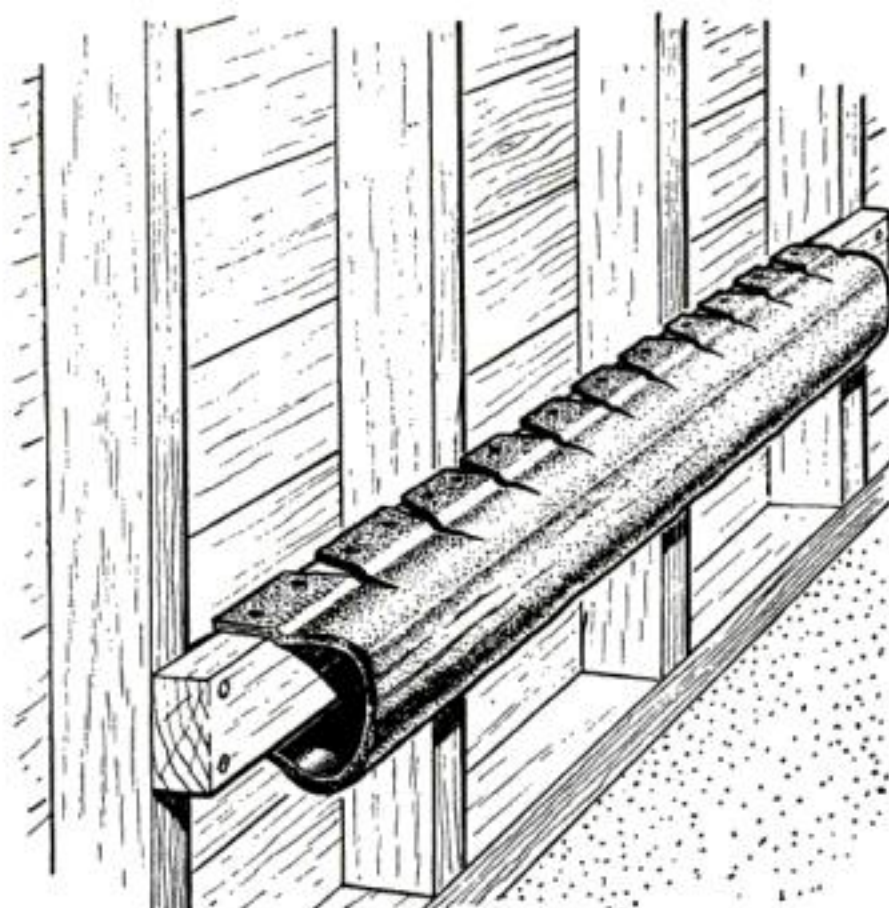
The performance of the Sekonic Dualmatic 50 compares favorably with movie cameras costing considerably more than its modest \$60 price tag. It's distributed by Sekonic, Inc., 460 Park Ave. South, NYC.



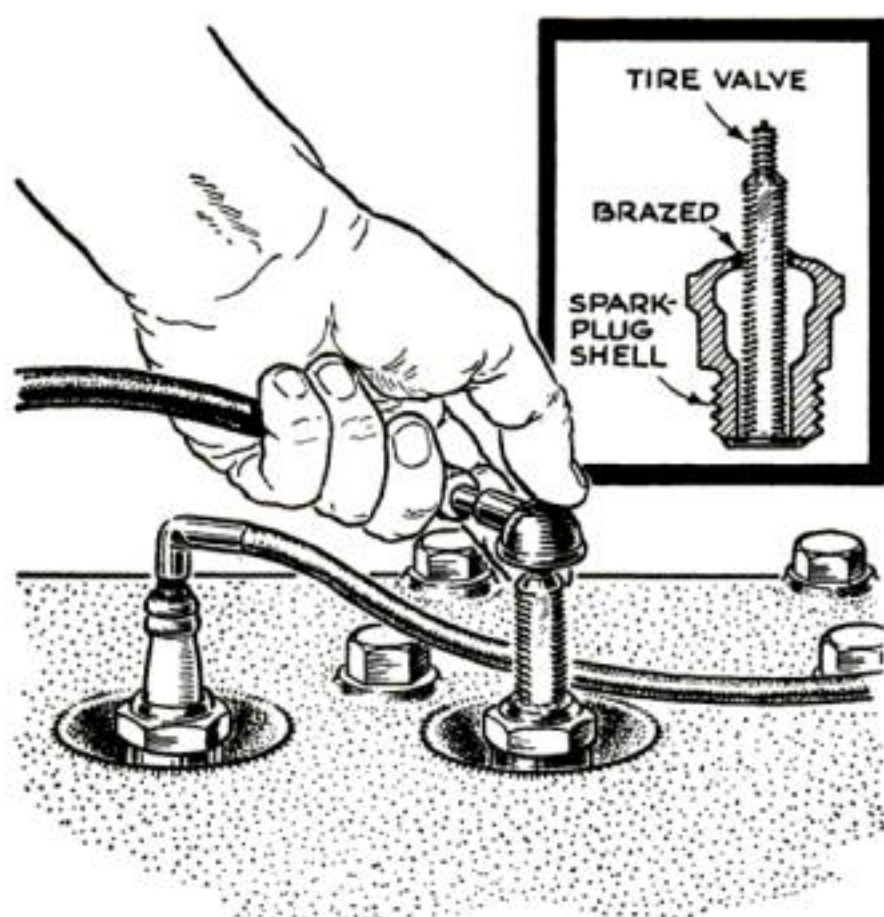
Hints from the Model Garage



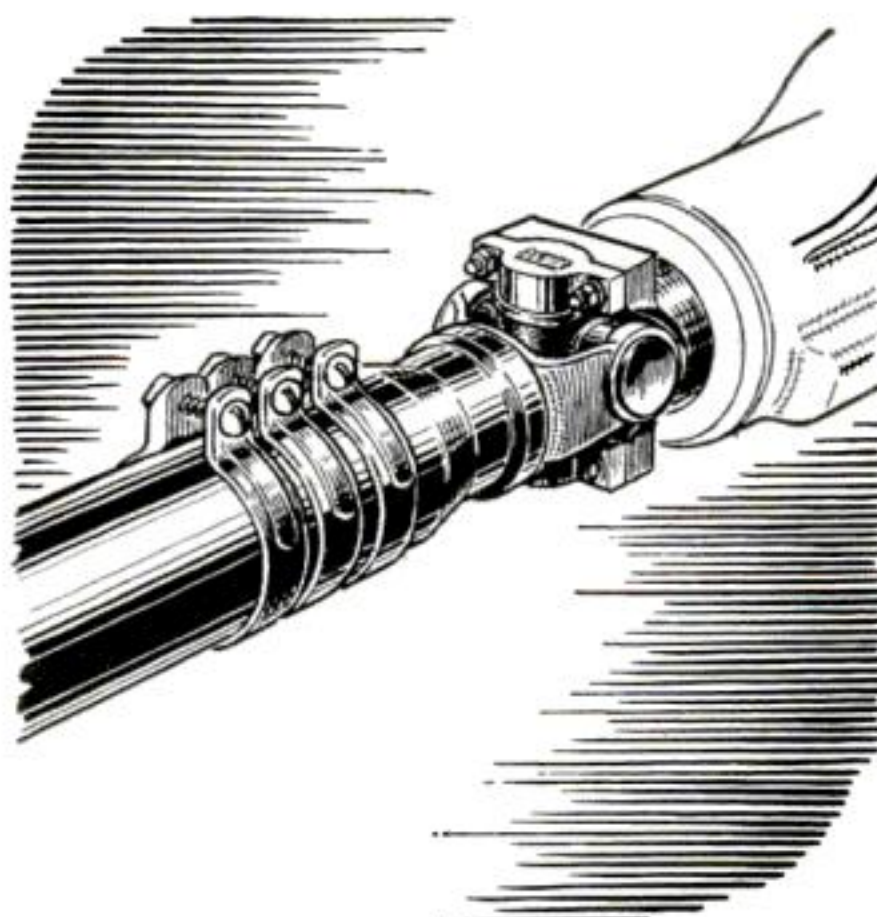
Avoid balancing wheels a second time when you remove a tube tire from its rim to repair a flat. A small dab of paint on both rim and tire will provide a handy guide for lining up the tire at the correct spot on the rim when you replace it.



A tough, resilient garage bumper can easily be made from an old tire. Slice off the tire beads first. Make about 10 or 12 slashes in the rims. Then nail a two-by-four to the garage studs at the level of your auto bumper and nail the tire over it.



Compression testing is easier with this tire valve brazed into a spark-plug shell. Set the cylinder at TDC between compression and power strokes. Blow in air at 50 to 100 p.s.i. Escaping air at the carb intake or exhaust pipe pinpoints the bad valve.

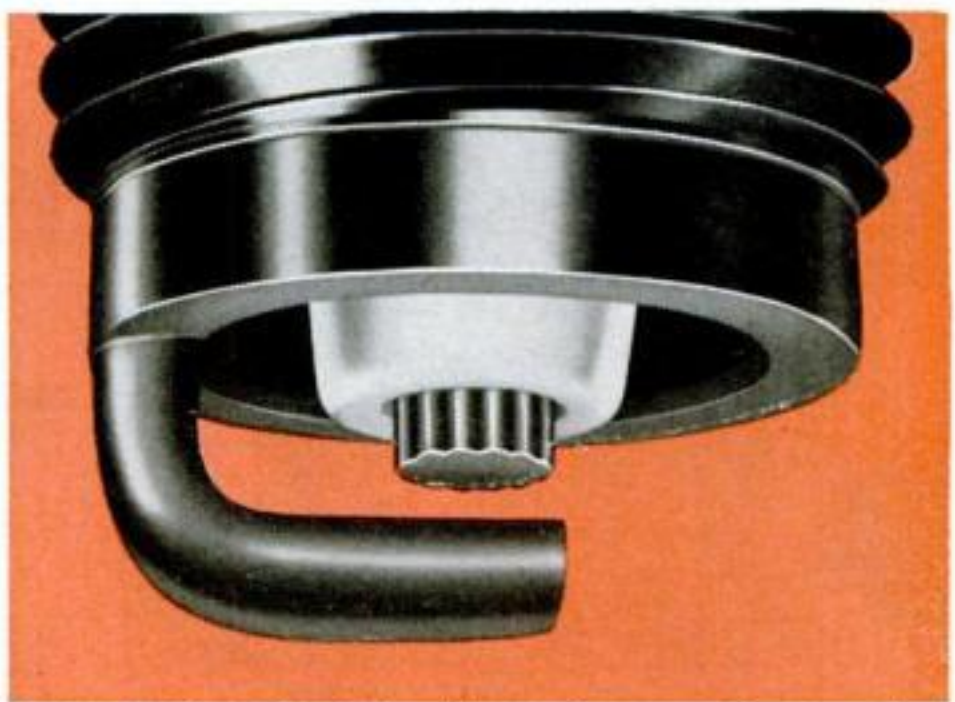


An out-of-balance drive shaft sets up vibrations that can sometimes be traced to a slight eccentricity or out-of-roundness in the shaft. To offset this, fit large hose clamps around the shaft, lining up the tightening screws on the light side.

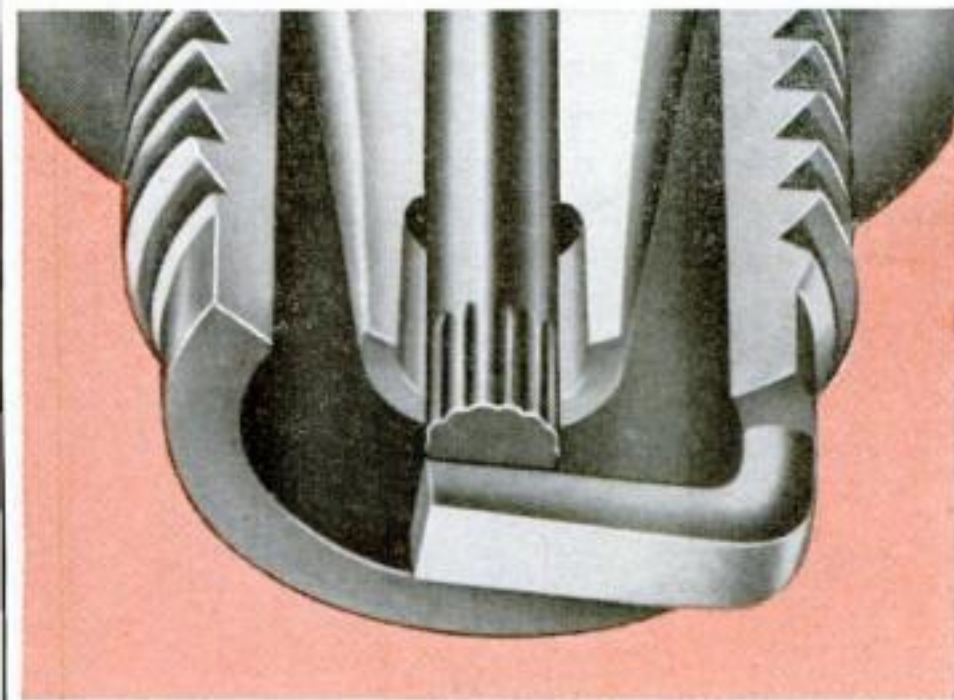
Why AC Spark Plugs stand up better under all driving conditions



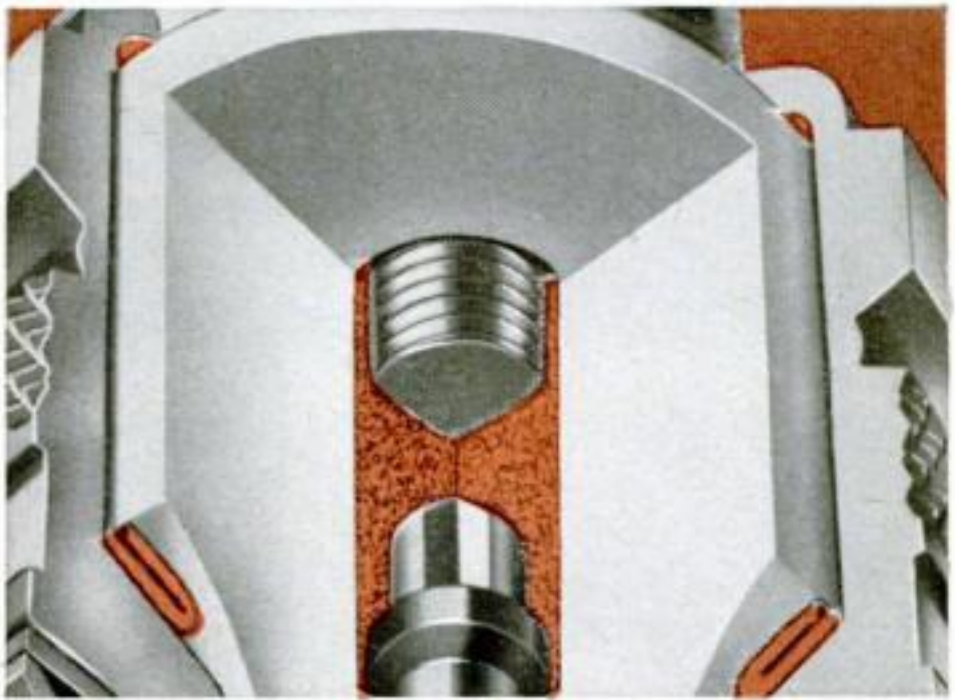
Tough alumina insulator provides better heat dissipation, resists cracking and chipping.



Electrodes of Isovolt alloy resist wear. Center electrode is knurled for better sparking longer.



Self-Cleaning Hot Tip heats faster to burn away fouling deposits, cools faster to resist engine-damaging pre-ignition.



Metal-glass inner seal and pressure-tight construction help prevent combustion gas leakage, keep heat range constant.

No matter how or where you drive, AC Fire-Ring Spark Plugs stand up better because they are built to deliver longer-lasting peak power and performance under all operating conditions. ACs help give you a big bonus in driving benefits, too—quicker starts, more power, smoother operation and better gasoline economy. AC's unique combination of proven reliability and performance features is found in no other spark plug. Ask for AC Fire-Ring Spark Plugs next time you change.



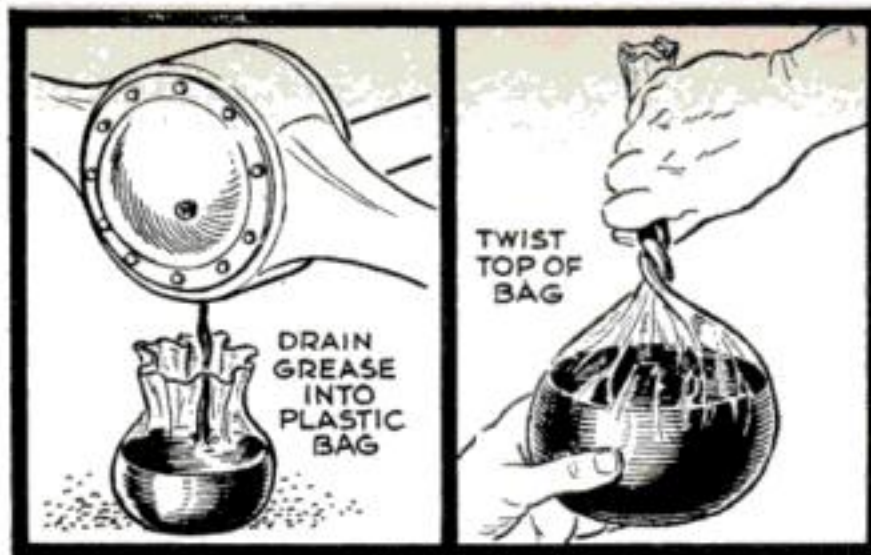
**FIRE-RING
SPARK PLUGS**

AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS

More Hints from the Model Garage

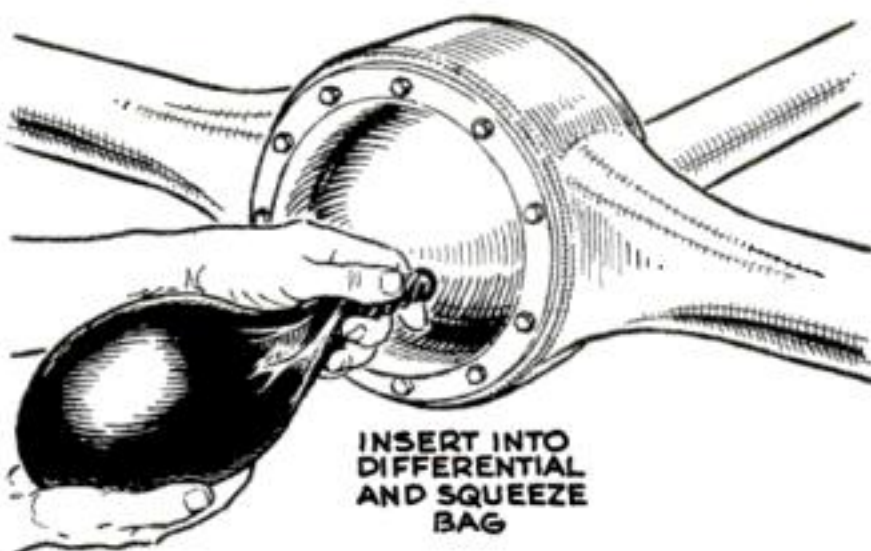


Light up the opening for your oil dipstick by taping a small penlight to the top of the stick. Then spot the opening with a few dabs of luminous paint. You'll not only save time and trouble finding the hole, but you'll have a spare flashlight handy.



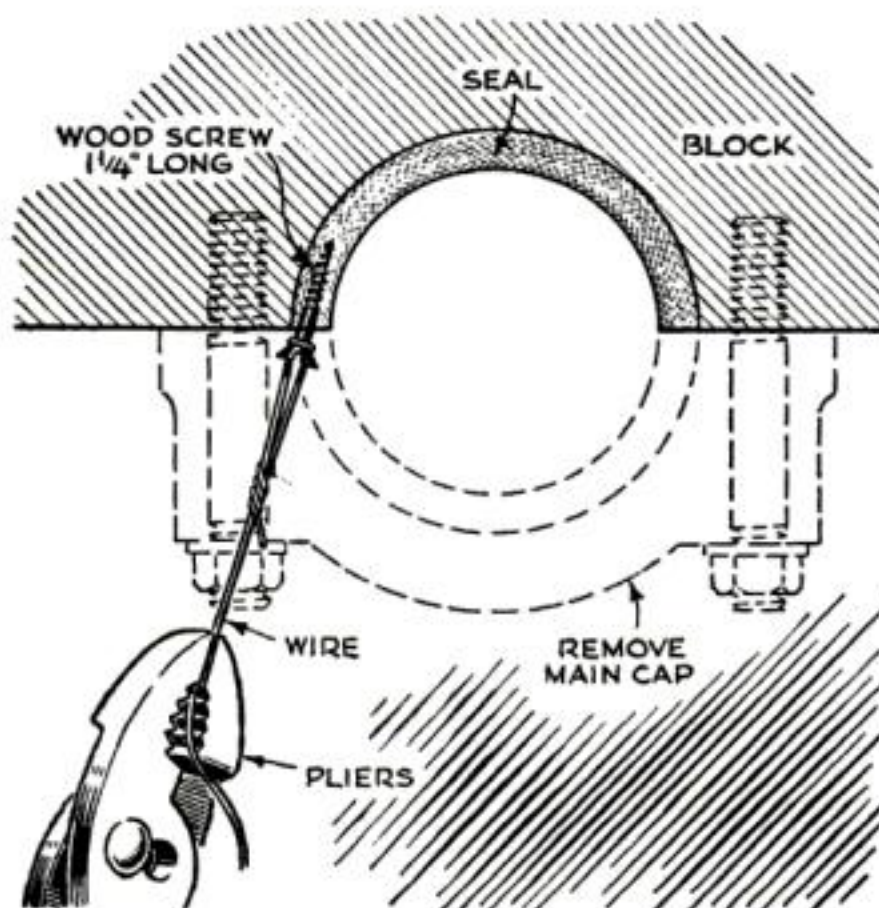
DRAIN
GREASE
INTO
PLASTIC
BAG

TWIST
TOP OF
BAG



INSERT INTO
DIFFERENTIAL
AND SQUEEZE
BAG

When the differential needs work, you may want to save the grease to replace later. Using a plastic bag makes the job easy. Give the top of the bag a twist to store the grease until your work is finished. Then squeeze the grease back in, as shown.



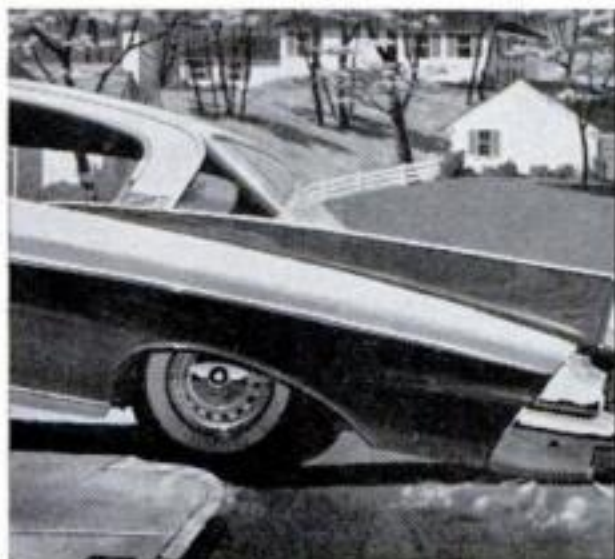
To free a rear main-bearing seal, first remove the bearing cap and drive a wood screw diagonally into the side of the seal, as shown. Then wind a wire around the screwhead and pull the seal out with pliers. The screw provides an anchor to pull on.



To clean a car engine with degreaser solution, try applying it with a pump-type insecticide sprayer. The spray coats the engine with a fine, clinging film that gets into hard-to-reach crevices. It also saves waste from excessive dripping and runoff.



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SWAYING ON CURVES? Side sway is dangerous, throws passengers from side to side, causes uneven tire wear. Give your car that sure-footed "sports car feel" with new Super Load-Levelers. the 60-day



Monroe Load-Leveler. Ask about free ride.



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Gus Helps a Homesick Car

By Martin Bunn

"LADY to see you, Gus," Stan called through the open office door of the Model Garage.

"I have to go out on a call," answered Gus Wilson, hanging up the phone. "But I guess it can wait a minute . . ."

He looked past his young assistant. Seeing who the customer was, he grinned.

"A minute won't do for Daisy Allen," Gus amended. "I'll leave her to you, Stan."

Stan groaned. "Not me, Boss . . ."

"Get with it," insisted Gus. He let himself out the back door as Stan trudged morosely back into the shop.

"Mr. Wilson's on a call. Can I do anything, Mrs. Allen?" Eyeing the '53 Ford six she had driven in, Stan remarked, "That isn't your car, is it?"

"No, it's my parents'," replied Daisy Allen. "I'm staying with them this month while my husband is on a business trip. They take it to a garage in Newtown, but I think it's a nice change for a car to be taken to a different garage sometimes, don't you?"

"Yes, ma'am," said Stan numbly.

"Of course there's nothing actually *wrong* with it—nothing you could *fix*. I told my father, but he's old and doesn't understand, and wants it looked at. I did want to go shopping, so I brought it here."

"Sure, Mrs. Allen. But what is—I mean, what's supposed to be wrong with it?" pleaded Stan.

"Oh, it skips or misses. Like a naughty horse that doesn't want to leave its stall. And for the same reason."

"I'll check it out," promised Stan. "Please call back later."

Daisy Allen bobbed a hat strewn with improbable blossoms. "I will. But don't do anything *drastic* to it, because it runs fine

once it's a few miles away from home."

Stan quietly ducked under the hood.

Meanwhile, Gus, turning off onto Wayne Avenue, rolled along the paved side of the newly widened highway, noting that the other side was still under repair. Three miles farther on he swung into the gateway of a housing development for senior citizens and stopped in front of number 17.

A woman came out, almost girlish in a shift house dress. She had silver hair and snappingly bright blue eyes.

"I'm Mrs. Townsend. Mr. Townsend is asleep, and I'd rather not wake him. He didn't want me to call you. Please come here."

She led the way to the attached garage and stood by as Gus raised the door, revealing a popular V-8 sedan. There was a strong odor of gasoline.

"Smell it?" she asked. "It even gets into my kitchen, which is right alongside. I'm afraid to light the stove some mornings. Usually I open the garage to get rid of it, so when my husband gets up it's not so strong. Sometimes I don't smell it at all. But today it was so bad I left it shut and called you. My husband insists there's no gas leak in the car, but I think there must be."

"Does seem that way," agreed Gus.

The woman went into the house. Gus inspected the carburetor, fuel pump, sediment bowl, and fuel lines. Everything was tight and dry. Whistling softly, he went behind the car, lay down, and shrugged himself under the gas tank.

A dry film of road dust testified to its soundness—except at one end. Here a moist stain showed where gas had seeped around the corner of the tank and dripped to the floor. Gus felt up the curve of the filler pipe. It was slippery with fuel. He wiped it dry.

After a minute or two, he checked it

"Didn't find anything, did you?" asked the stocky little man.



again. Only a faint trace had reappeared. Sliding out, he almost cracked his head on the bumper as a voice startled him.

"Didn't find anything, did you?"

Rising, Gus's eyes traveled up a stocky little figure in shorts. Gray eyes under an egg-bald skull repeated the question. In one hand the little man cradled a large pipe, while the other was knuckled over a lighter.

"I wouldn't light that just now," said Gus mildly. "Smell the gas?"

Townsend sniffed. "Tell the truth, I don't. Had a cold all week. But don't tell my wife. She fusses." He put pipe and lighter away. "Mean to say there *is* a leak?"

"When did you last fill the tank?"

"Midnight, after the late shift at Murdock's. Got a part-time job there."

Gus nodded. "Looks like it's lost all it's

going to, so we won't drain any. You see, that gas was cool when it went in. Then the car stood in this sun-heated garage. The gas had to expand. With the tank full, it had no place to go but out the edge of the filler cap, down the pipe, and onto the floor.

"Even when you get gas daytimes, it comes from a cool underground tank. Fire departments get complaints every hot day about cars spilling gas because they're parked in the sun. Just don't say 'fill it up.' Leave some room for expansion."

Townsend nodded. "I should've thought of that myself. What do I owe you for setting me straight?"

Gus told him. As Townsend handed over the price of a road call, he cocked his head apologetically. "Would this cover a bit of advice about my power mower?"

CONTINUED

165



"According to Daisy Allen, we've got a homesick Ford on our hands."

"Why, sure," agreed Gus.

"It's a two-cycle rotary that worked fine last year. But it's lost a lot of pep this season. I had the carburetor cleaned, and put in new points and a plug. That didn't help at all."

Townsend had pulled the machine out.

"Don't start it," said Gus.

Pulling the cable off the spark plug, he tilted the machine enough to put a wrench on the nuts that held the exhaust pipe on the cylinder.

Squeaking protest, they came off. Gently Gus wriggled the pipe free. The exposed exhaust port was rimmed with a thick black edging of carbon.

"There's what mower owners usually skip when tuning up fuel and ignition systems," explained Gus. "That carbon deposit cuts the size of the exhaust port way down. Back pressure then fights the engine, reducing power. Sometimes it causes pre-ignition and overheating."

"Crank the engine over so that the piston is out of the way, and scrape out the carbon. Take care not to scratch the opposite cylinder wall or nick the port edges, though. You'll find the old pep is back. I always yank off the plug cable first, because these one-lungers could start up when you pull the blade around by hand—and I need all my fingers."

"Me, too," said Townsend. "I'm a machinist. Thanks for both jobs of trouble-shooting. All I got to worry about now is telling my wife she was right."

On his return, Gus found Stan sweating from more than the day's warmth.

"Got Mrs. Allen straightened out?"

"Boss, I can't even straighten myself out. She told me the engine misses, but not to fix it because it runs fine away from home. I locked up for five minutes to drive it around the block. No miss."

The telephone shrilled.

"No, Mrs. Allen," said Gus as soon as he could wedge a word into her chatter. "The car ran well when we test-drove it. Exactly when does it seem to miss?"

"Only when we drive it away from the house, of course. After a few miles it knows who's master, and behaves. It just likes to stay in the garage."

"Mrs. Allen, you say it acts up only when you drive away? Not other times?"

"Of course not. And it runs nicely all the way back, too, the way horses used to do when they knew they were going back to their stables at—"

"Sorry, Mrs. Allen," interrupted Gus in desperation. "Somebody at the pumps."

He hung up and went back to Stan.

"According to Daisy Allen, we've got a homesick Ford on our hands."

Stan grinned fiendishly. "See what I mean about that dame, Boss?"

"At least she has an open mind."

"Yeah. A hole in the head," muttered Stan. "Look, Gus. Compression checks out good. Fuel pump ditto. The carburetor is new, and it's the right one. Float level's okay, the choke works, ignition points are good and gapped right, spark is hot and regular, timing right on the button, plugs clean. Now what," Stan demanded, "could I have missed?"

"Whatever makes it miss when it's headed away from the garage."

"Boss! You don't believe that horse-to-its-stall flap?"

Gus shrugged. "In trouble-shooting, you listen to every tip and then parlay your hunches. I had a man complain his car went clickety-clack only on Webster Avenue. Couldn't find a thing wrong, so I drove it there myself. Sure enough. It was an echo from a picket fence."

"Okay, I'll drive the car where she . . ."

Stan fell silent.

"Well, what're you waiting for?"

"It's her folks' car," explained Stan. "I don't know their name or address."

It was Gus's turn to grin fiendishly. "Then you'll have to wait and drive there *with* her when she gets back."

"Oh no," wailed Stan as Daisy Allen

CONTINUED



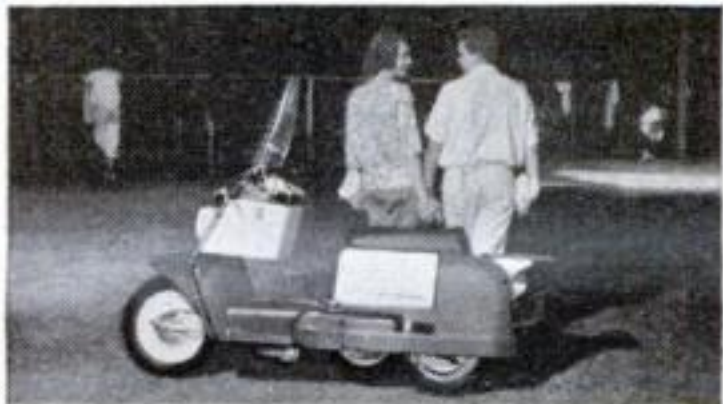
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minced up the ramp. He put her in the car and came into the office.

"They live in that development for retired people out Wayne Avenue. It'll take about half an hour, I guess."

"Wayne Avenue?" mused Gus. "Stan, want to play one of my hunches?"

"Sure do, Boss," said Stan fervently.

"Try Hickman Road first. If the trouble shows up there, come right back."

Ten minutes later, Stan returned with the car and Mrs. Allen, voluble as ever. "... didn't dream it would act that way anywhere else. My father is right. I do hope you can *do* something . . . of course, it could be just temperamental . . ."

Gus emerged from the office. "There's a cup of coffee for you on my desk, Mrs. Allen. Want to sit there and relax?"

With fluttery thanks, she went off.

"Don't know how you guessed, Boss, but it bucked like a rodeo steer on that rough road. On pavement, it's smooth."

"Let's look for loose connections."

With the engine running, Gus and Stan checked every terminal on the battery, regulator, coil, distributor, and ignition switch. All were tight. The switch itself was sound; wiggling the key in it caused no skip in the motor's idling beat. Then, together, Gus and Stan rocked the car violently side to side on its springs.

The motor coughed a little but kept running.

"It's flooding," said Gus. Taking a drop-light and a hammer, he shone the light on the glass bowl of the carburetor, then shorted out a plug with the hammer head. The engine, which had settled back to a

smooth idle, rocked as that cylinder cut out, then sputtered as before. Inside the bowl, Gus saw the float rattle from side to side.

"See that? The float hinge in this new carburetor is too loose," he told Stan. "On a rough road, the fuel level jumps all over. The engine floods, bucks, and the float gets shaken up even more."

"Got it, Gus," said Stan with relief.

Turning off the engine, he lowered the bowl and gently squeezed the eyes on the float hinge closer. With the float free to move up and down but not to shake sideways, he replaced the bowl and again checked the float level. On Hickman Road, the car performed faultlessly.

"*Funny about her,*" said Stan as Daisy Allen drove out. "She tries to tell you the facts, but you have to throw out the hokum to spot 'em. Like that flap about the car bucking when it leaves home but running okay on the way back."

"That was no flap."

"Aw, Boss. Don't give me that. I'm still trying to figure out how you knew the trouble would show on Hickman Road."

"Because it's a rough dirt lane."

"Yeah, but I remember that development has paved streets, and Wayne Avenue is a two-lane concrete road."

"Last time you looked, maybe. They've been widening it since," said Gus. "The northbound lane is finished, so the car ran fine when headed home. But the southbound lane—the one coming this way—is all torn up. As Daisy Allen said, that car knew it every time it was leaving home. The bumps told it." ■ ■

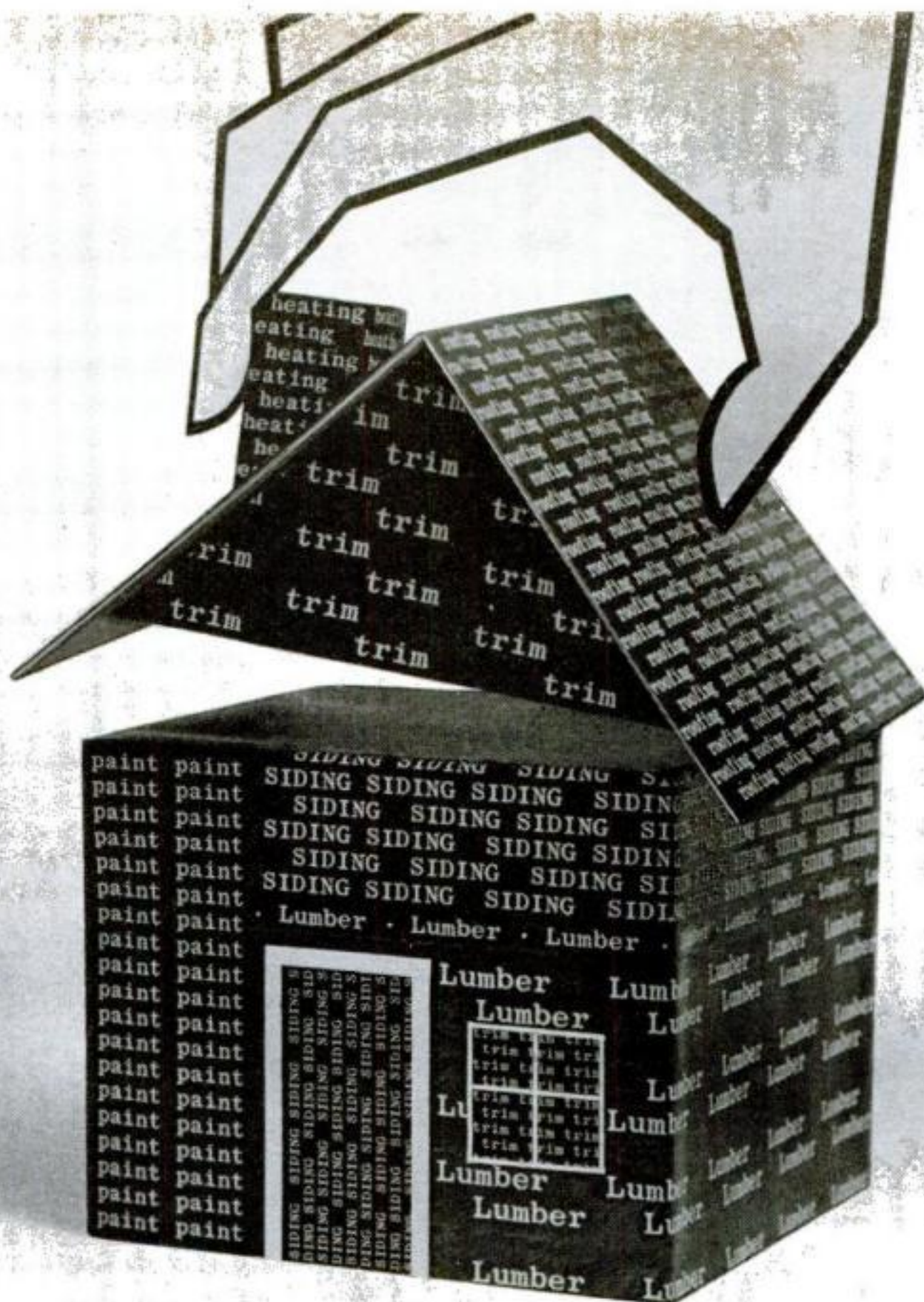
Maintenance shop travels with job

These two 35-foot trailers move with road-construction crews, providing an all-weather shop for repairs on lengthy but temporary jobs.

They are set up 50 feet apart and bridged with a roof of steel strips bolted together and to the trailers. There are drops for the open ends. The floor is a concrete slab. Guy F. Atkinson Co., South San Francisco,



uses the setup here on a two-year road contract in San Leandro, Calif.



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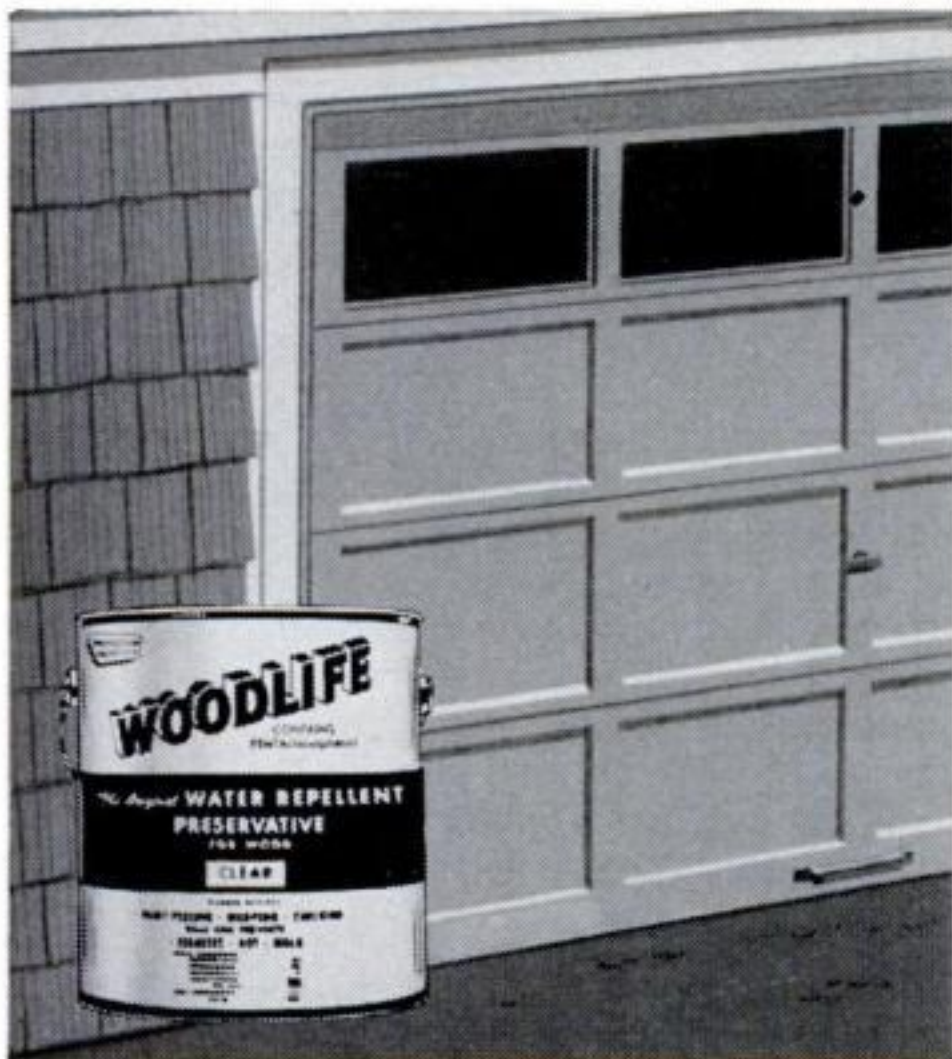
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SHOP TALK

By Sheldon M. Gallager



New tool for small shops: a metal-cutting nibbler

It isn't often that an industrial tool finds its way into home shops, but here's one that just might. It's an electric-powered nibbler, shown at left, that makes straight or curved cuts in sheet metal as easily as a saber saw zips through wood. The people at Skil Corp. in Chicago patterned it after industrial models except for one thing: Its price—\$64.95—is intended to make it a practical buy for small-shop use.

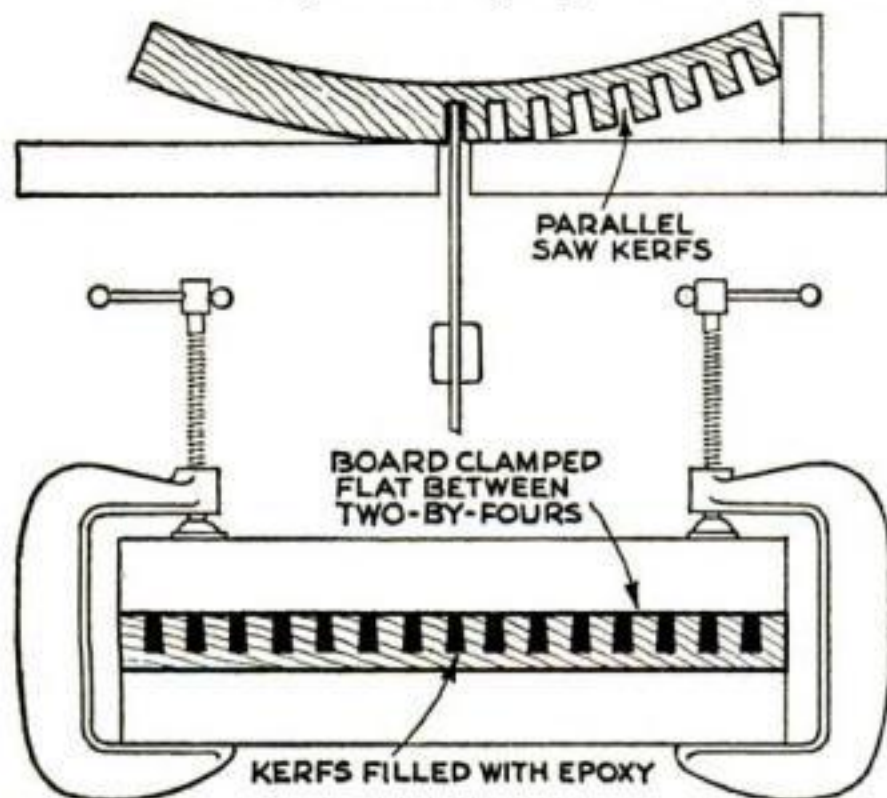


The tool's eccentric drive is like a saber saw's except that it moves a carbide punch, instead of a blade, up and down. Because it punches rather than shears, you get clean cuts without mangled edges. While maximum recommended cutting thickness is 18 gauge in steel, we found this to be on the conservative side. The nibbler actually breezes through aluminum, brass, and mild steel up to 1/16" thick with no back talk. Because the punch takes a fixed number of bites per minute, there's no slow-down on thicker metals—the cutting rate remains the same. We made repeated tests on various thicknesses and always clocked the same result—18 seconds per foot. This figures out to a whopping 40" per minute.

Looking for scrap metal? Here's good news

If you've had trouble finding steel, aluminum, and brass for metalworking projects, you can now buy them in kit form from American Edelstaal, Inc., 350 Broadway, NYC. The kits include assorted sizes of rod and bar stock from 1/2" to 1" in all three metals. Prices range from \$2.25 for the steel kit to \$3.95 for brass.

New job for epoxy: Now you can straighten a warped board



Taking the warp out of a piece of fine furniture, such as a table leaf, used to call for elaborate steam-bending equipment—with not always successful results. Now modern epoxies make possible this simpler trick:

Make a series of blind, parallel saw cuts on the underside, sawing with the grain about two-thirds through. Start and stop the cuts just shy of the board's ends so they won't show. Next, clamp the board flat and fill the cuts with epoxy filler. Depending on the direction of the warp, the cuts will open up or squeeze together. Either way, the epoxy holds them in their new position, and out comes a permanently flat board.

How to pick the right glue for every job

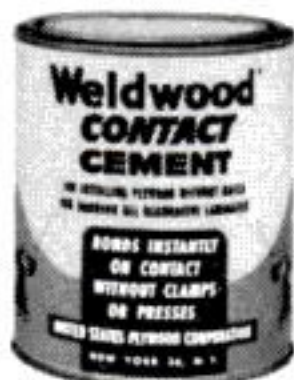
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	HOUSEHOLD REPAIRS china, glass, metals, plastics, porcelain		INTERIOR WOOD CABINETS, BUILT- INS, FURNITURE		INSTALLING PLYWOOD WALL PANELS		PLASTIC LAMINATES TO PLYWOOD OR PARTICLE BOARD	CONCRETE TO CONCRETE, WOOD, MASONRY	PAPER TO PAPER, FABRIC, CARDBOARD	CANVAS OR FELT TO WOOD	CORK TO WOOD	HARD- BOARD TO WOOD	BOATS (WOOD)	LEATHER TO LEATHER, WOOD	METAL TO METAL, WOOD, MASONRY	CHINA TO CHINA, GLASS	EXTERIOR WOOD OUTDOOR FURNITURE, SPORTS EQUIPMENT, WOOD TO WOOD, CORK, CANVAS
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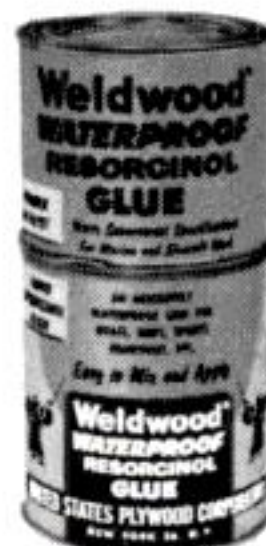
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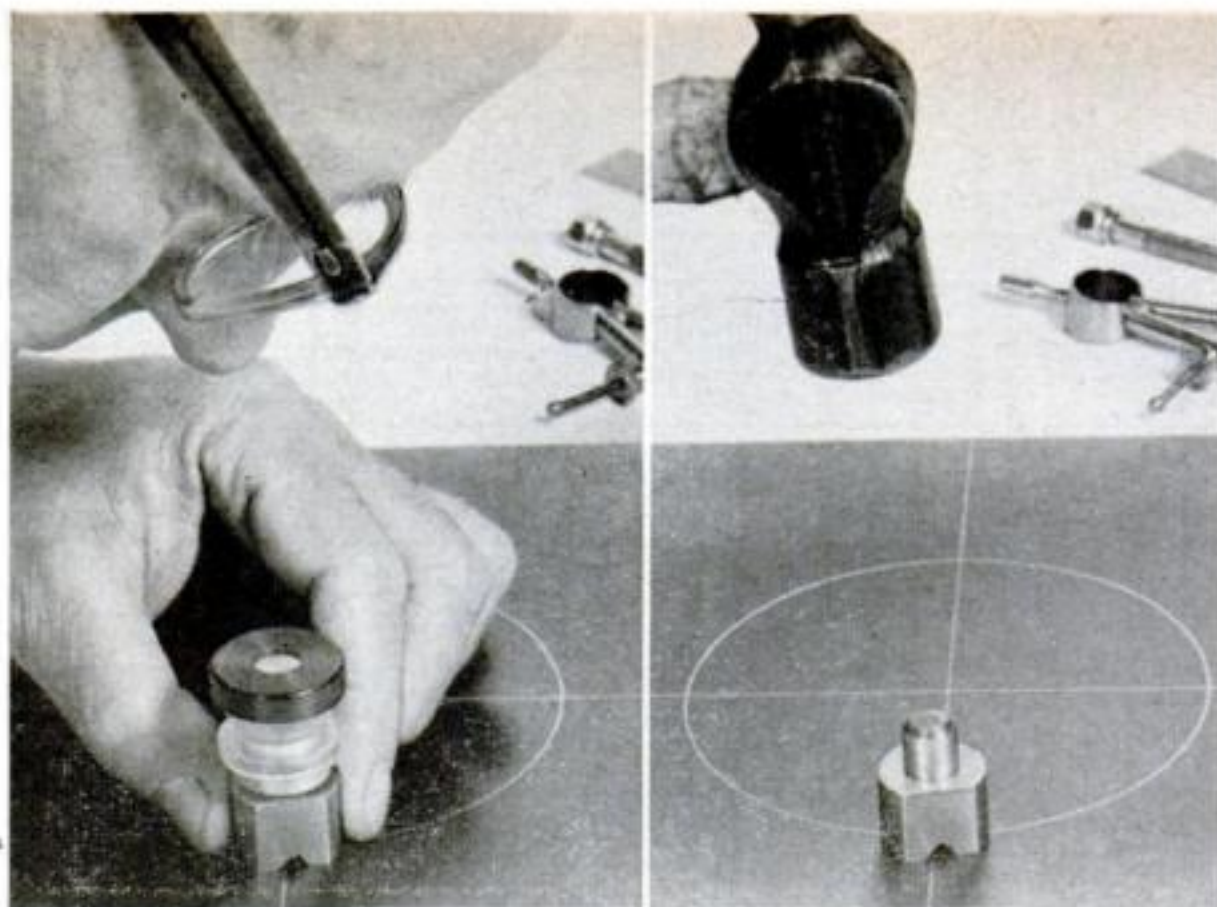
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Cross Hairs "Sight" New Metal Punch

Lining up this unusual center punch for accurate marking of holes in metal is like sighting a rifle. It has a magnifying viewer with cross hairs that fits into the top. You line up the mark you want punched with the cross hairs, as at left. Then you remove the magnifier, slip in a conventional punch, and give it a tap. The punch is said to be dead true within .002". The punch holder



has a magnetic base so it stays put during the operation. Price is \$11.10 from Sprayon Products, Inc., 26300 Fargo Ave., Bedford Heights, Ohio.



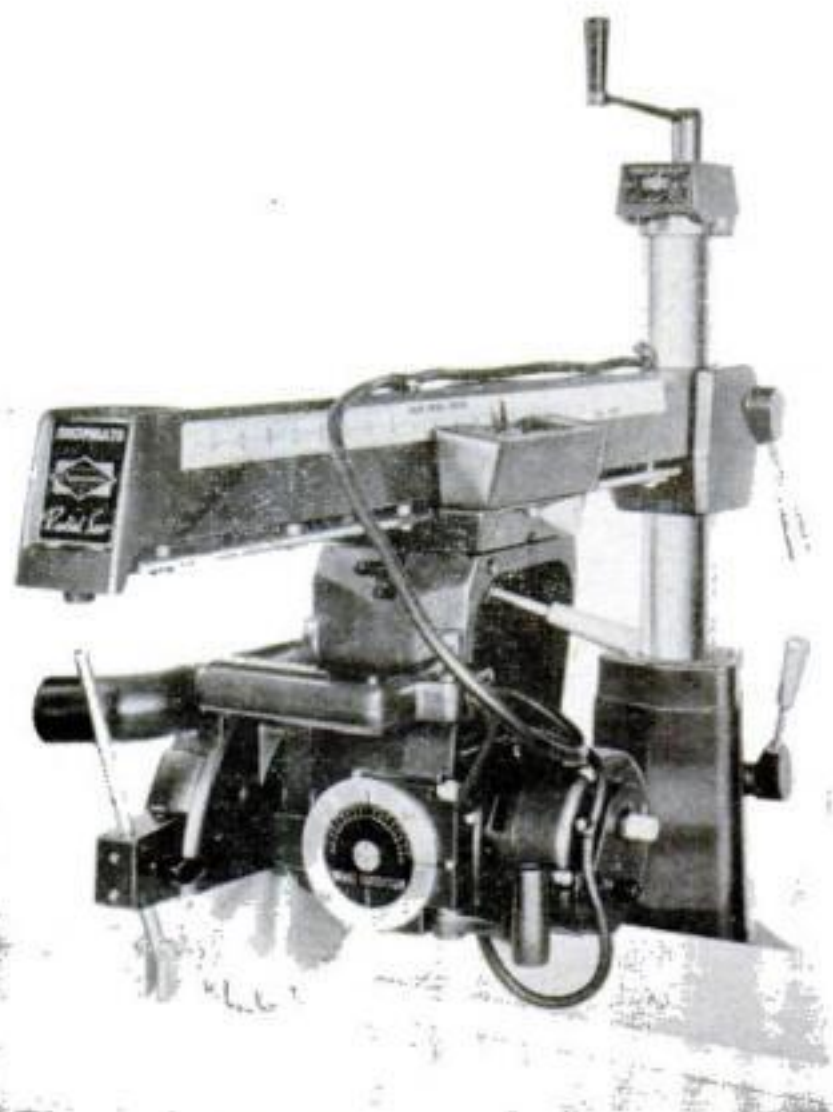
Inflated wheels grind with belts

This bench grinder uses inflated wheels with slip-on belts to do the work of hard grinding wheels. Advantages: The flexible wheels are safe and take many types of interchangeable belts. Prices: \$99.50 for a ½-hp., two-wheel model; \$59.50 for a ¼-hp., single-wheel model. Nu-Matic Grinders, Inc., 875 E. 140 St., Cleveland.



Hammer "holster" clips to your belt

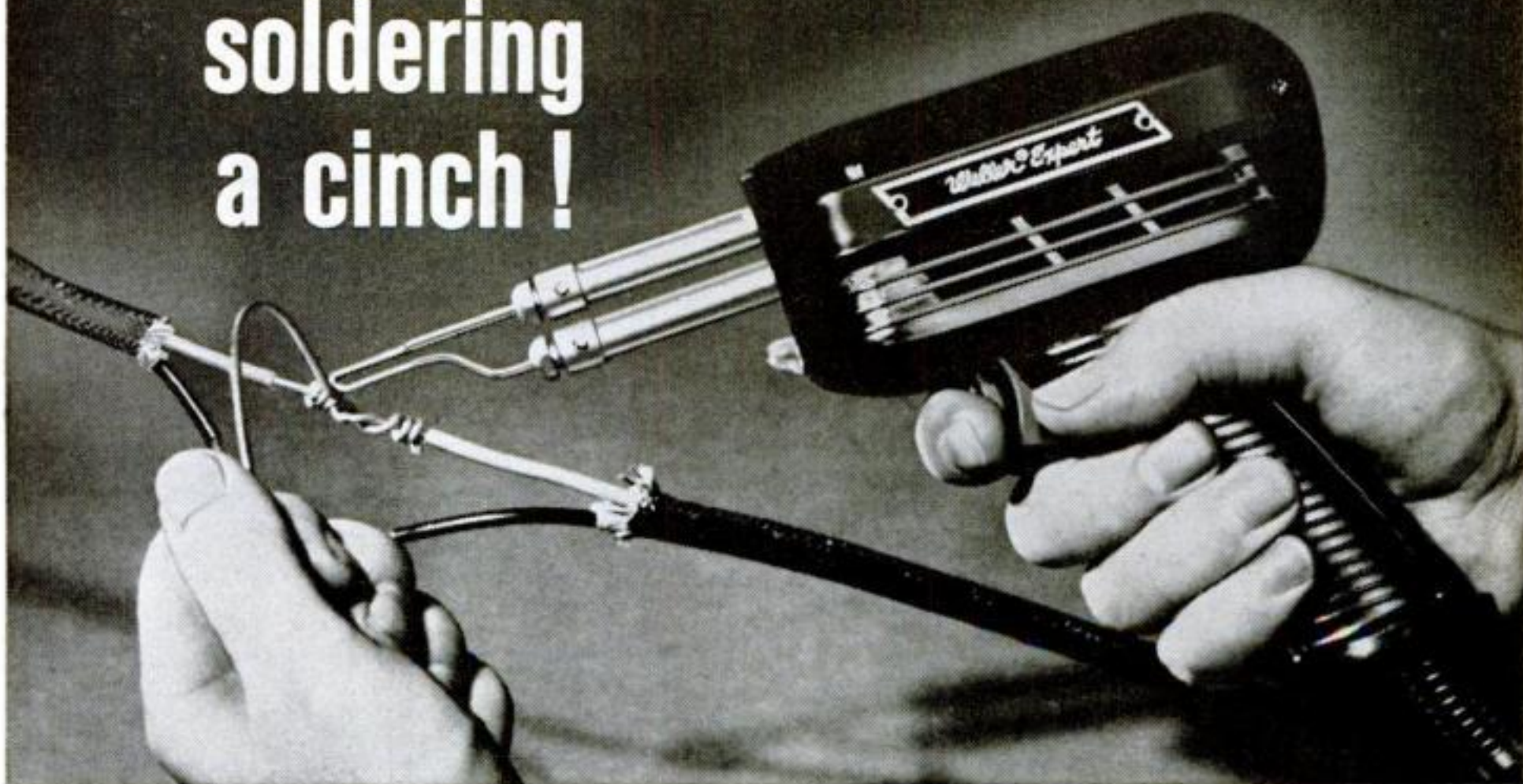
The Weyerhaeuser lumber people have come up with a wire holster that holds a hammer neatly by your side, ready for use. You can get one for 50 cents at local dealers or from Weyerhaeuser Co., Box B-196, Tacoma, Wash.



Three-speed saw has three spindles

Three separate spindles give you a choice of three different motor speeds on this new Shopmate radial saw. There's 3,450 r.p.m. for grinding, buffing, and drilling; 5,000 r.p.m. for sawing, dadoing, and molding; and 10,000 r.p.m. for routing and shaping. \$189.50, Portable Electric Tools, 1200 E. State St., Geneva, Ill.

Makes soldering a cinch!



Weller® Dual Heat Soldering Gun

There's no tool like a Weller Dual Heat Gun for quick, easy soldering and scores of household repairs. Pull the trigger—tip heats instantly and spotlight illuminates work. 2 trigger positions give you a choice of two tip temperatures. You can switch instantly to the heat best suited for the job. And by using high heat only when necessary, you prolong tip life.

Tip is made of copper for superior heat transfer and premium-plated for rigidity and long life. Accessory tips

are available for heat sealing, cutting and smoothing.

Over 5 million Weller guns have been sold. They're used by professional servicemen and homecrafters the world over. All Weller guns are UL approved and guaranteed one year against defects in material and workmanship.

Weller dual heat guns are available in many models with wattage ratings to suit your needs. They are also supplied in plastic case kits that include accessories.



A must for hi-fi kit building. Assures noise-free connections. Use low heat when soldering near sensitive components, high heat for chassis connections.



Saves on electrical repairs. Enables you to do many appliance and electrical repair jobs yourself. Also useful for many different crafts and hobbies.



Mends metal. Whether patching holes, sealing seams or joining metal parts, your Weller gun will pay for itself on scores of repair jobs around your home.



Does more than soldering. With cutting and smoothing tips you can cut plastic tile, repair plastic toys, seal plastic bags, repair furniture dents, etc.

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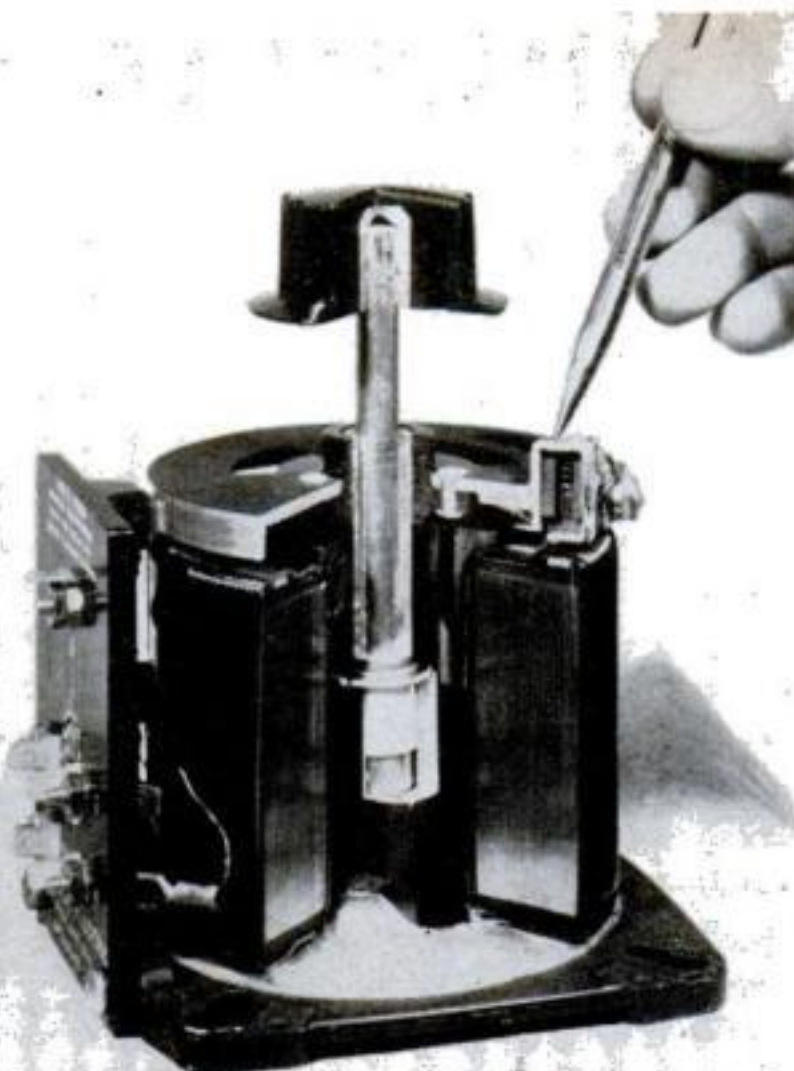
what's new

ELECTRONICS

Now They've Built a Better Transformer

FIRST major redesign of the variable transformer in 25 years is the claim made for the new General Electric VOLT-PAC.

New units are available in 120-volt or 240-volt ratings with current capacity ranging from 2 to 65 amperes. A unique heat-sink ring dissipates heat along a gold-plated brush track. The new design is said to give 100 percent greater overload capacity.

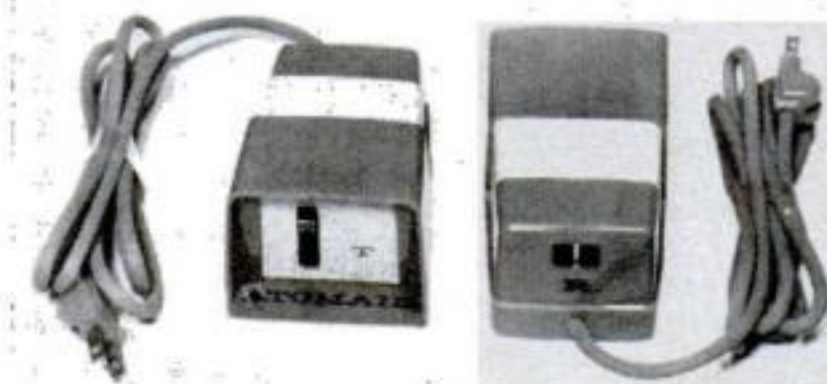


Portable phono runs on flashlight cells

More than 250 playing hours on just six flashlight batteries is claimed for this fully transistorized, four-speed phonograph. The new Mercury Compact weighs only eight pounds and is carried like an attaché case. It plays 7", 10", and 12" records. Price: \$59.95. Mercury Phonographs, 35 East Wacker Drive, Chicago 1.

Tester checks circuit continuity

Originally developed to speed production of complex electronic equipment in industry, the Pro-Glo circuit tester is now available to the general public at retail. Tester has self-contained battery and lamp. Price: \$1.30. AMF, Box 929, Alexandria, Va.

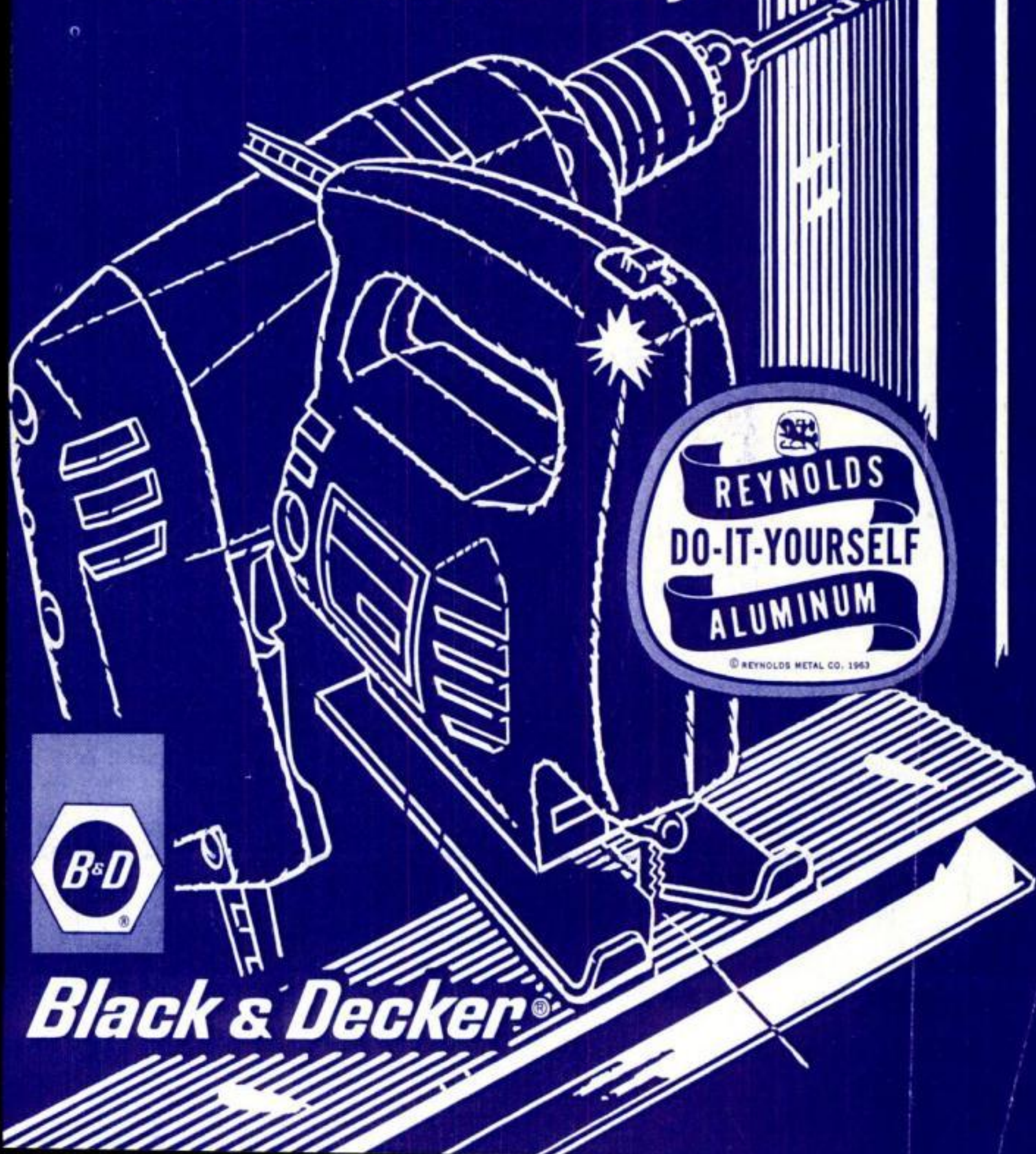


Remote-control on-off switch

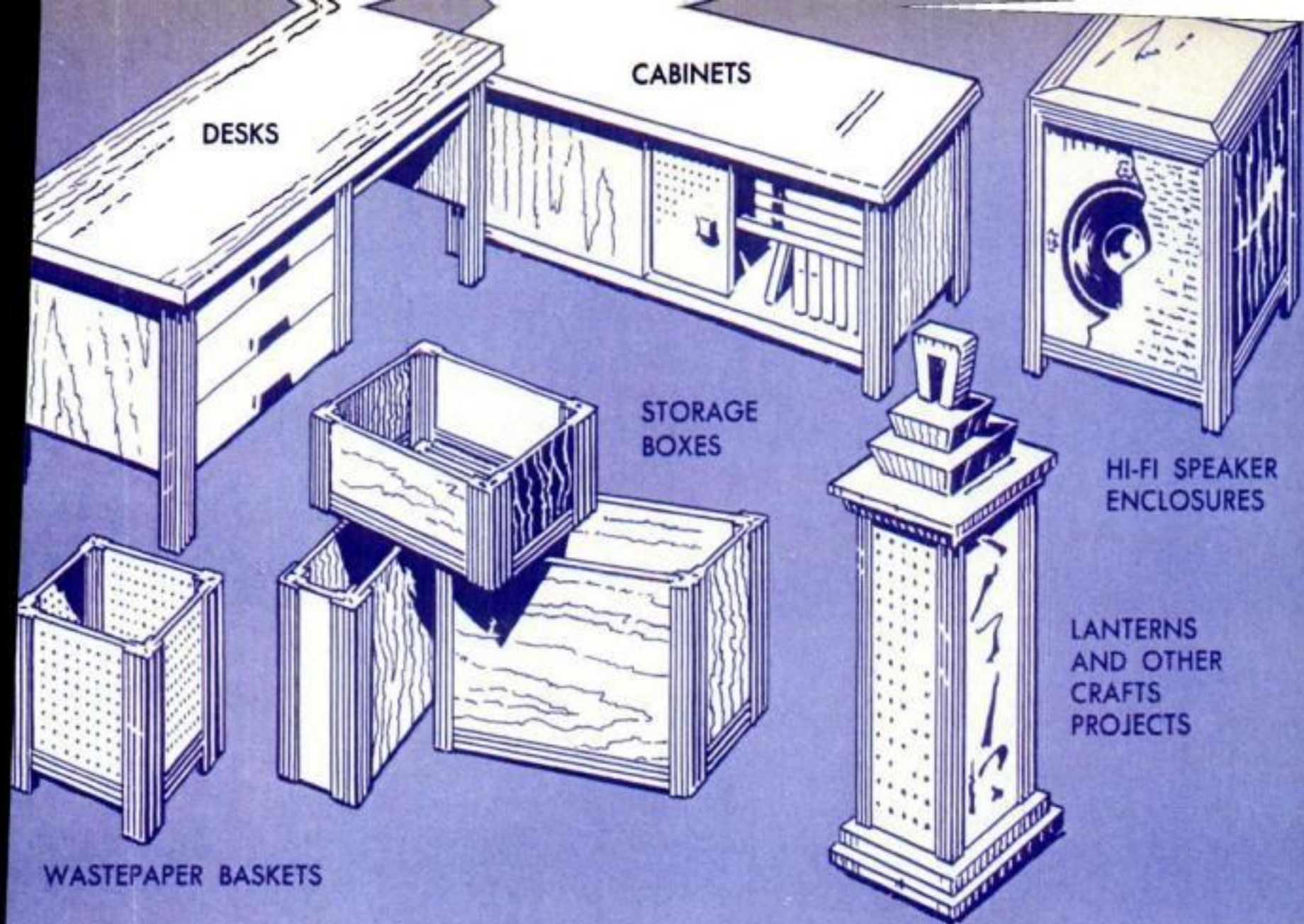
This electronic remote-control system will let you operate any lamp or appliance from anywhere in the house. Simply plug the transmitter and receiver units into any wall outlets. No other connecting wires are needed. The Atomaid sells for \$59.95. Available from Gentronics, 3224 Sixteenth Ave. West, Seattle 99.



Assembling Furniture and Partition Panels the Modern Way



Black & Decker®



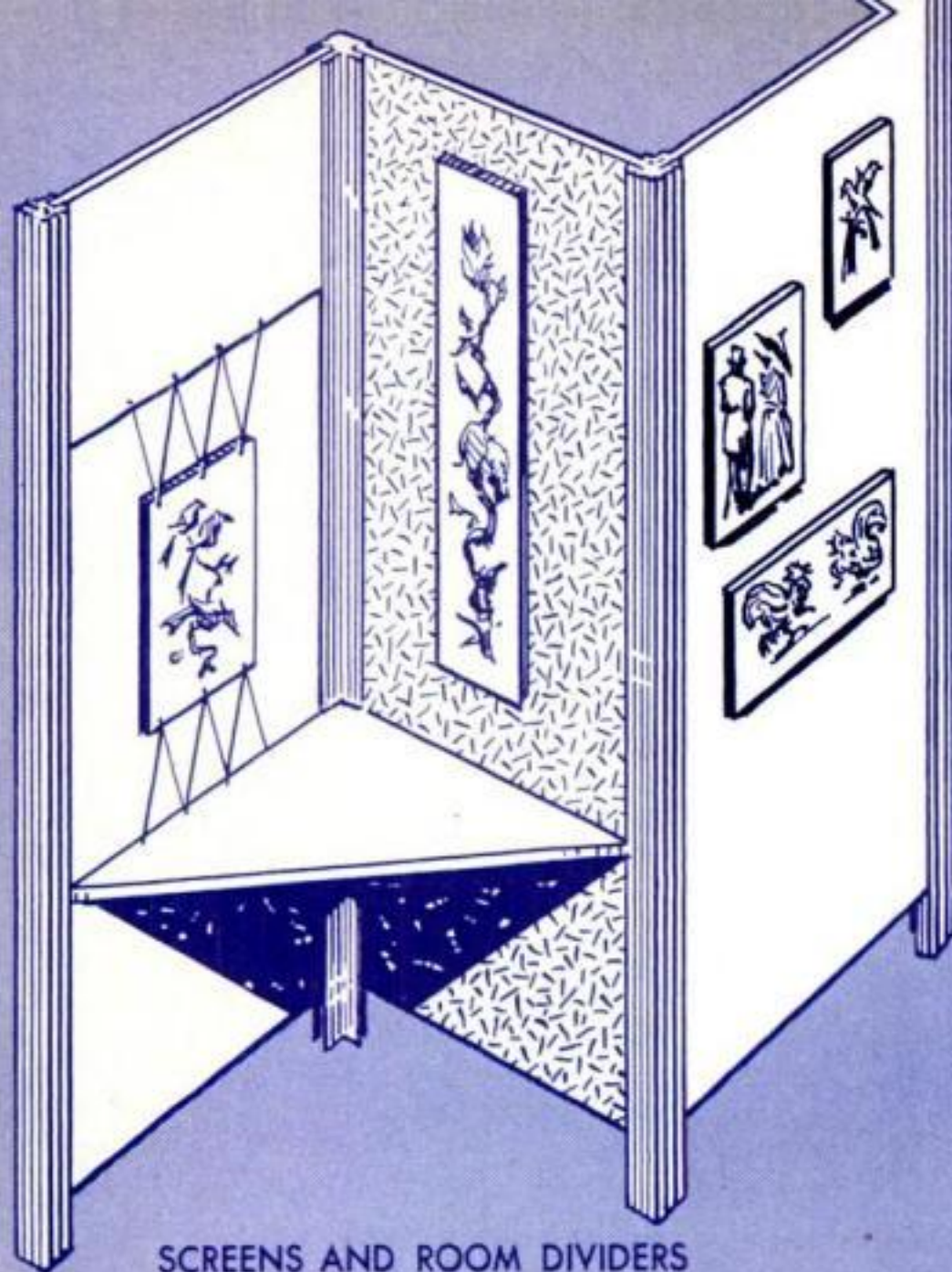
The team that makes panel joining accurate,

Corner posts and "H" extensions.

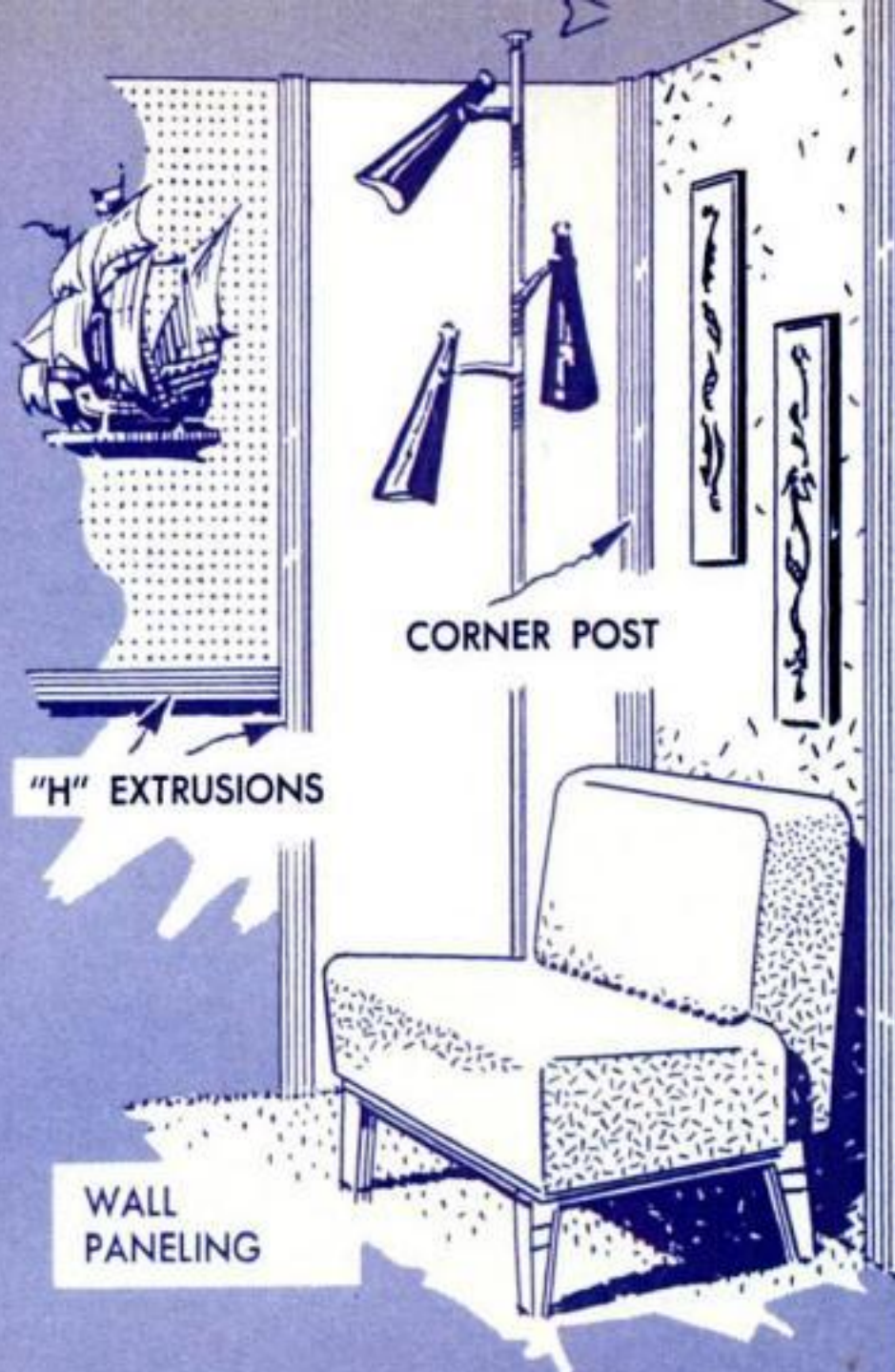
Whether you go for down-to-earth construction jobs about the house, or sophisticated cabinetwork and furniture building, these newest members of the Reynolds "Do-It-Yourself" Aluminum line are real time savers. They're 8' lengths of handsomely-finished, enduring metal, shaped to take all the fuss and bother out of panel joining.

Examine their cross-sections and you'll see why. Each corner post provides two deep pockets set accurately at right angles. Slip panels into the slots and even if you've strayed on edge-cut measurements you can shift parts around until everything is firm and square. Reynolds matching "H" extrusions offer similar pockets placed back-to-back for strong and slightly in-line panel joining.





SCREENS AND ROOM DIVIDERS



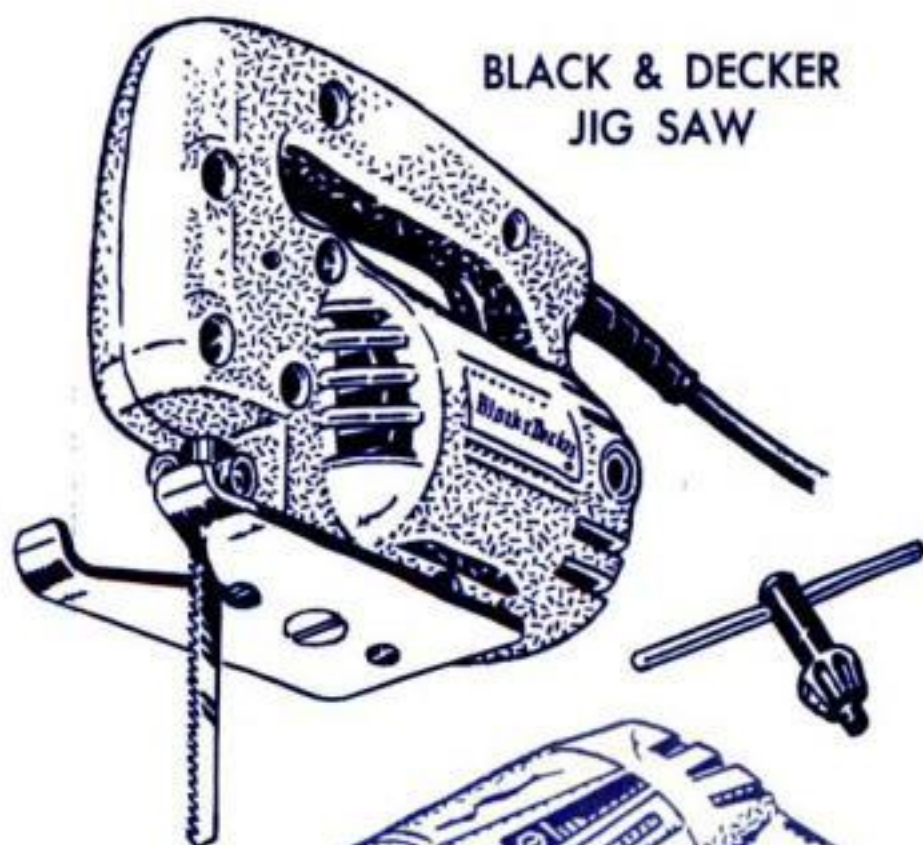
"H" EXTRUSIONS

CORNER POST

WALL
PANELING

handsome—and easy

The right jig saw and drill. Black & Decker—Number 1 in the power tool business—offers the finest jig saws and drills you can buy for cutting corner posts and "H" extrusion parts and driving holes for anchoring screws and bolts. Admittedly, aluminum is a cooperative metal, so much so that with inferior power tools holes may wander, or cuts go astray. It won't happen with B&D's precision-made and comfortable-to-the-hand drills and jig saws. You have a choice of models in both tools—Utility, Deluxe, or Professional. And when you pick your jig saw you'll be getting the right tool, too, for running off plain and fancy cuts in the panels you set between the aluminum members. wood, plywood, hardboard, perforated board, composition board, plastic—or you name the material.



BLACK & DECKER
JIG SAW

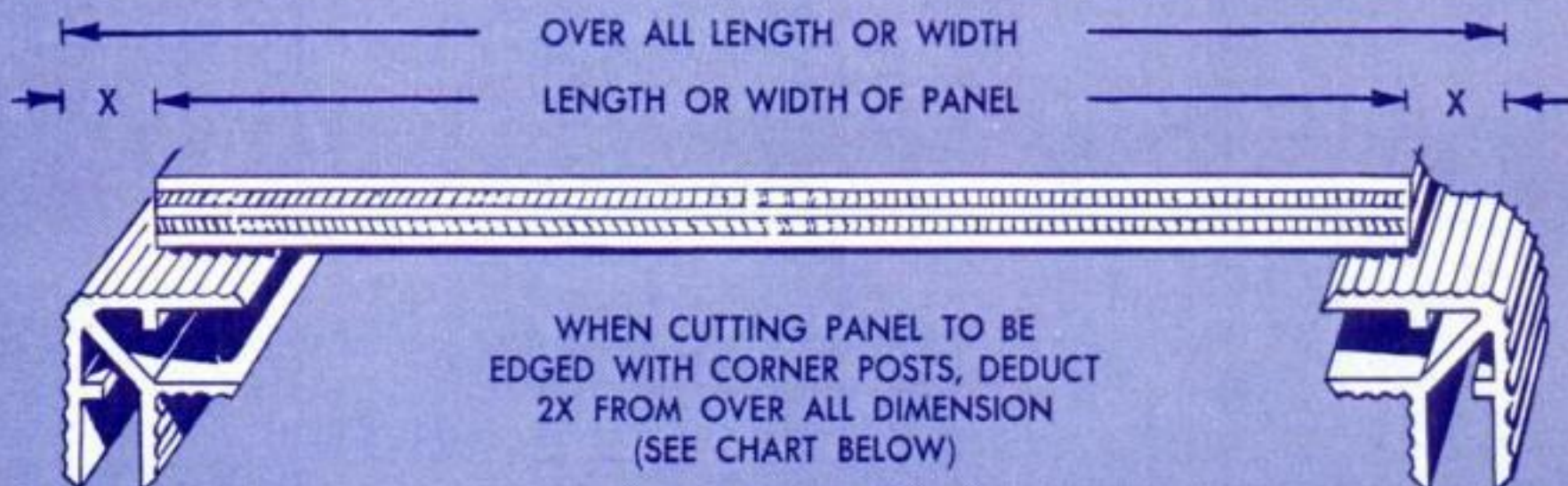


BLACK & DECKER
1/4" DRILL



CORNER POSTS FOR
 $\frac{1}{4}$ ", $\frac{1}{2}$ ", AND $\frac{3}{4}$ " PANELS

"H" EXTRUSIONS FOR
 $\frac{1}{4}$ ", $\frac{1}{2}$ ", AND $\frac{3}{4}$ " PANELS



Dimensioning and cutting corner posts, "H"

Corner post measurements. Reynolds Aluminum corner posts come in sizes to accommodate the three most popular construction panel thicknesses ($\frac{1}{4}$ ", $\frac{1}{2}$ " and $\frac{3}{4}$ "). All members are 8' long—allowing uninterrupted joints, where needed, for standard-length plywood and hardboard sheets.

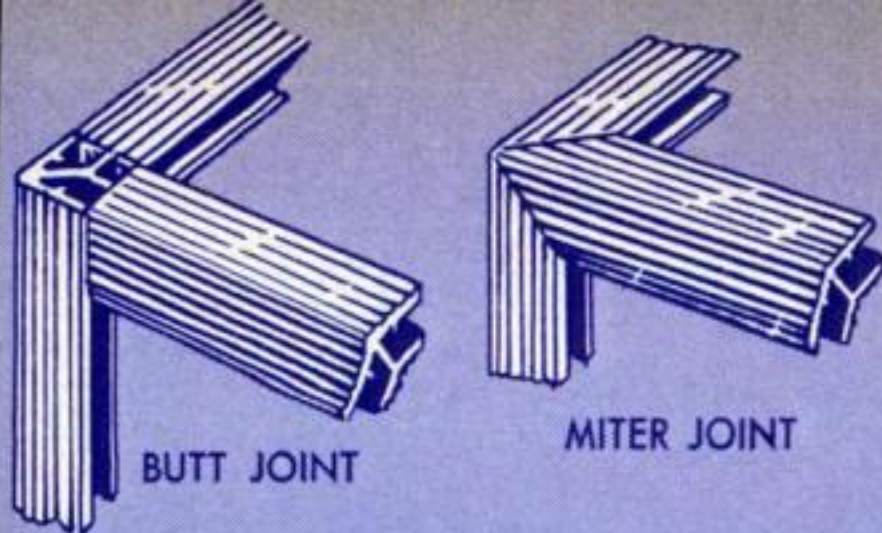
Because corner posts will determine the outside measurements of projects, it's generally best to cut them first. That way they'll offer a visual aid, if you have any doubts about panel sizing later. Plot your

work for minimum wastage. Often one combination of parts can just be squeezed from an 8' length, while another will leave much unusable stock. Make cuts with your Black & Decker jig saw, using a No. U-1354 non-ferrous metal cutting blade. Ease it through the aluminum at moderate speed and there'll be practically no burring. Where necessary, dress cuts with a fine-toothed file.

Remember that panels to be edged with corner posts are not cut to over all project length or width, but only for seating in the pockets between flanges. This is shown in the drawing above. Consult the chart at left for the exact amount to be deducted.

CORNER POST FOR	LENGTH OF X	DEDUCT 2X, OR
$\frac{1}{4}$ " PANELS	$\frac{3}{8}$ "	$\frac{3}{4}$ "
$\frac{1}{2}$ " PANELS	$\frac{5}{8}$ "	$1\frac{1}{4}$ "
$\frac{3}{4}$ " PANELS	$\frac{7}{8}$ "	$1\frac{3}{4}$ "

"H" extrusion measurements. Reynolds 8' "H" extrusions, too, are available for $\frac{1}{4}$ ", $\frac{1}{2}$ ", and $\frac{3}{4}$ " paneling. When dimensioning projects, allow $\frac{1}{16}$ " for the thickness of the web that separates the "H" flanges.



BUTT JOINT

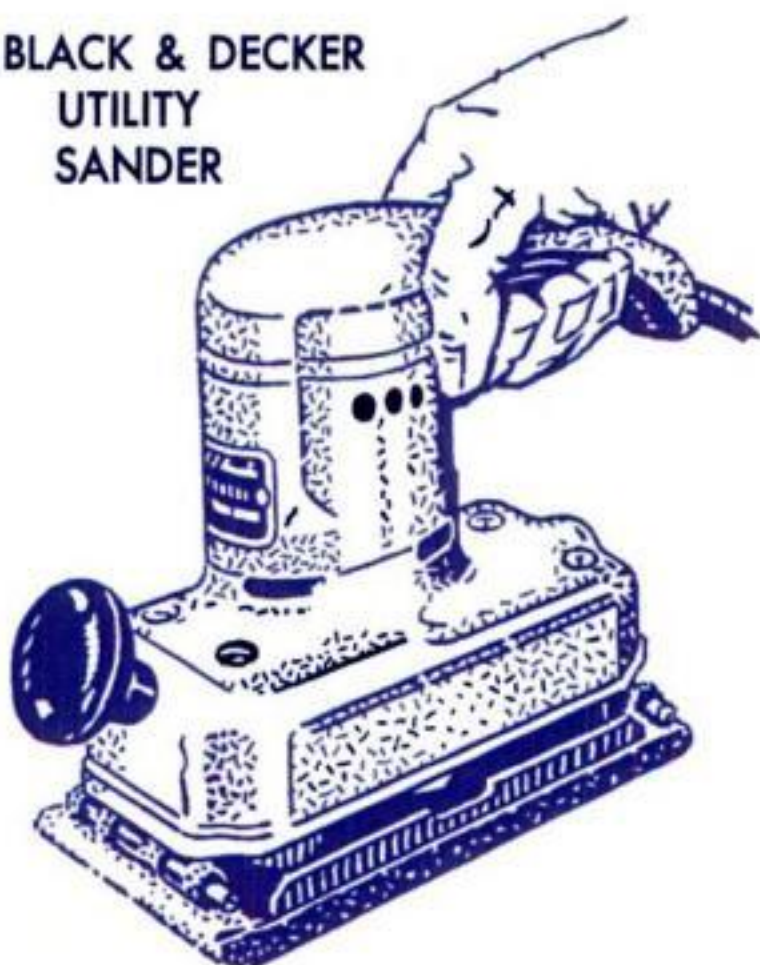
MITER JOINT

REMOVE ONE FLANGE
OF "H" EXTRUSION

45° JIG
SAW CUT

panel sheets effortlessly, safely, and accurately. B&D makes five models, each a top performer in its class. The most modestly priced—the 6½" Utility Saw—has enduring power far beyond the demands of paneling projects. As proof: It cuts through stock up to 2⅝" deep with ease. And don't forget those other B&D panel-working tools—husky finishing sanders that put a satiny finish on wood you've dressed down yourself.

BLACK & DECKER
UTILITY
SANDER



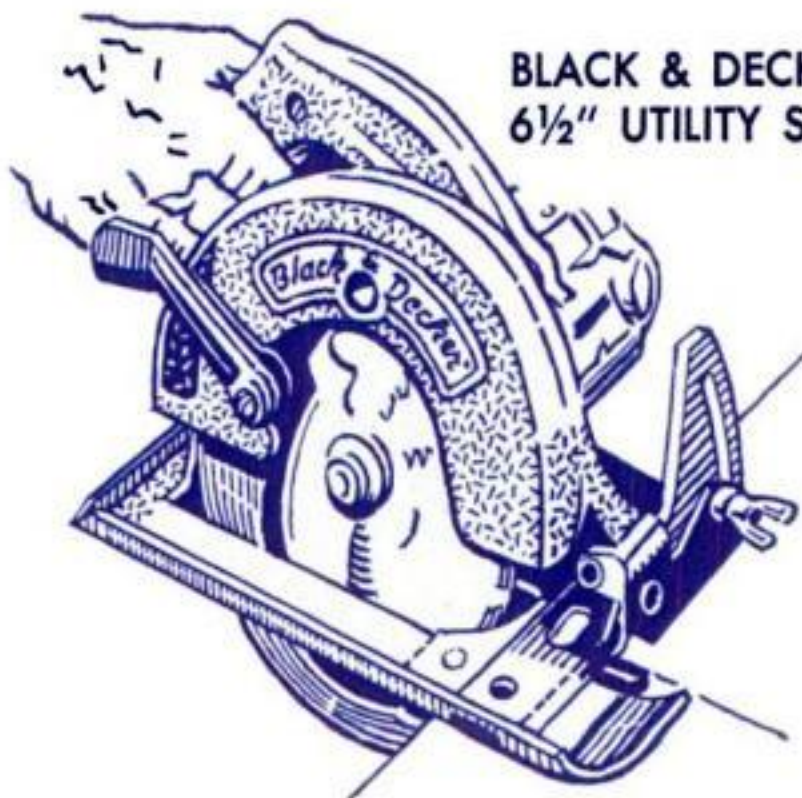
extrusions and panels

Butt joints. Simple and sightly, these are made with right-angle cuts. Usual practice is to cut uprights to over all heights and fit horizontals between them. Use a metal square to accurately guide the shoe plate of your Black & Decker jig saw across corner post and "H" extrusion flanges.

Miter joints. Here's an even more attractive way to form outside corners, and to frame openings for built-ins. When the former call for a three-way joint, make two 45° cuts across each corner post to a common apex. A simple miter guide formed from "H" extrusion stock provides a leading edge to ease your Black & Decker jig saw into the work at just the right angle.

Cutting and sanding panels. It's a great feeling to grasp the handle of a firmly-balanced Black & Decker circular saw, squeeze on the trigger, and zip through

BLACK & DECKER
6½" UTILITY SAW



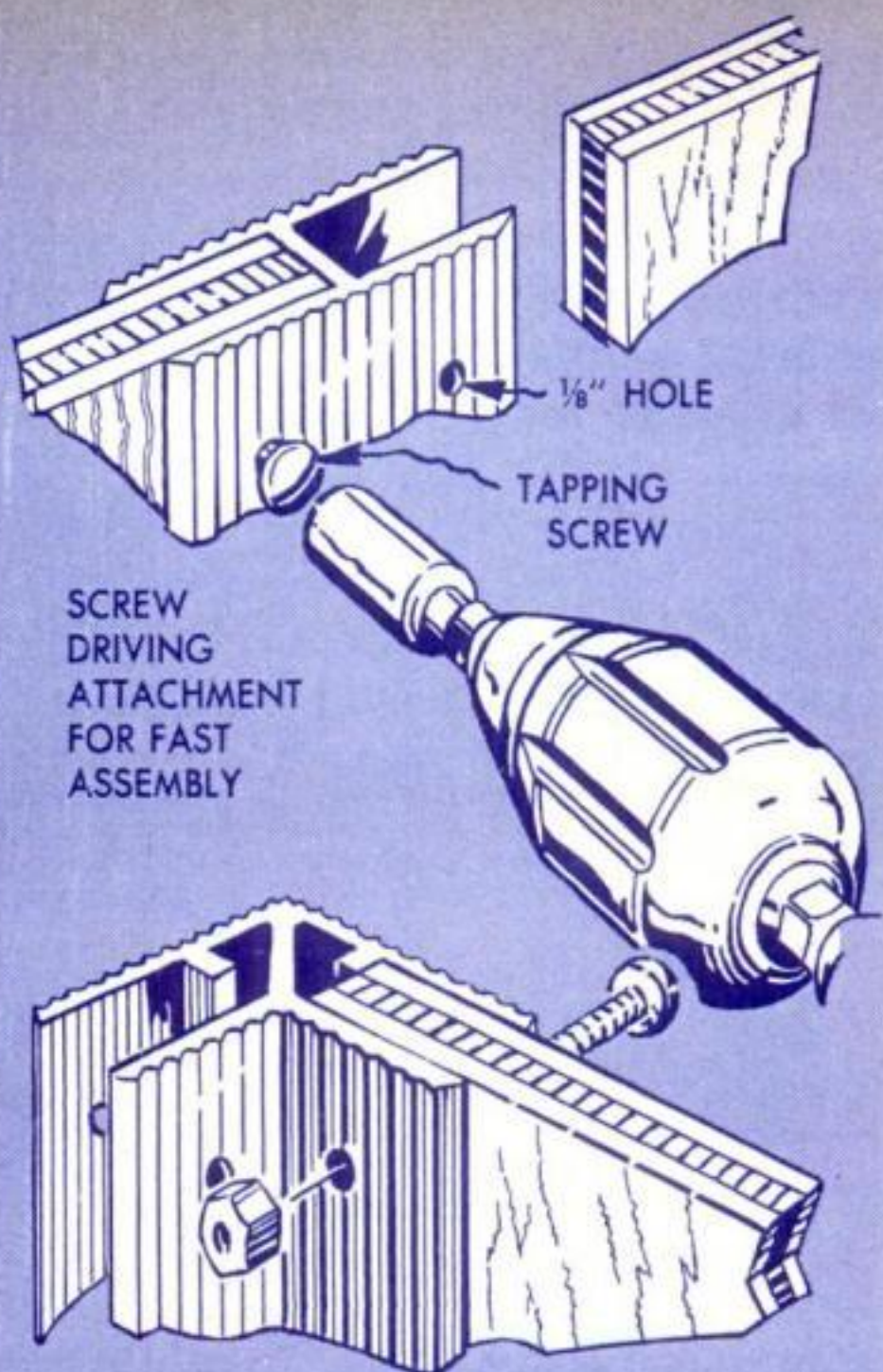
Anchoring panels is a breeze

Using tapping screws. Drill $\frac{1}{8}$ " holes 8" to 12" center-to-center through the inside flanges of corner posts, or the least exposed sides of "H" extrusions. Then insert panels to the right depth for desired measurements, and drive aluminum tapping screws. Use $\frac{3}{8}$ " screws for $\frac{1}{4}$ " panels, first filing off tips about $\frac{3}{32}$ ". With $\frac{1}{2}$ " and $\frac{3}{4}$ " panels use $\frac{1}{2}$ " screws. For fastest assembly, attach a B&D screw driving attachment to your Black & Decker electric drill.

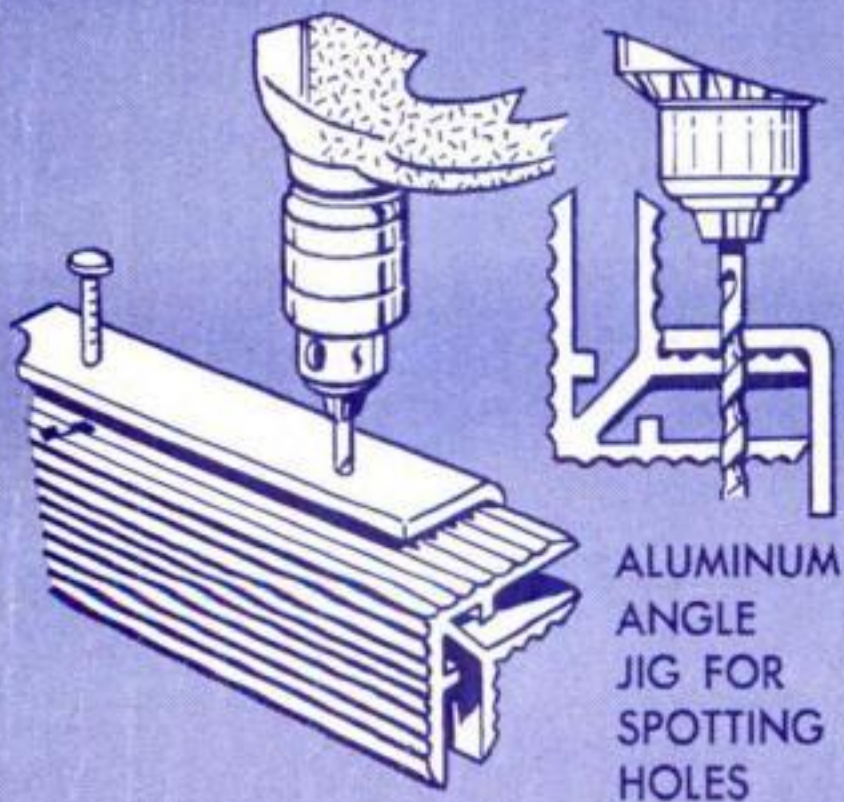
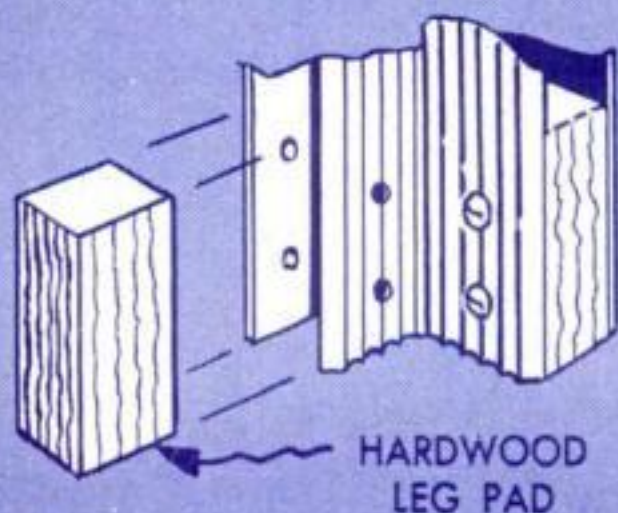
Bolt and nut assemblies. Planning to build an "occasional" room divider, a knock-down sandbox, or a summertime-only pool-side cabana? Reynolds corner posts and "H" extrusions are the ideal intercouplers for such store-away projects. Position panels between flanges and drill holes straight through assemblies for No. 10-24 aluminum bolts. Crank on aluminum nuts and everything's locked in place until the time comes for easy dismantling.

Leg pads. When corner posts are used as legs, insert small pieces of hardwood between flange ends to form pads. Secure with aluminum tapping screws.

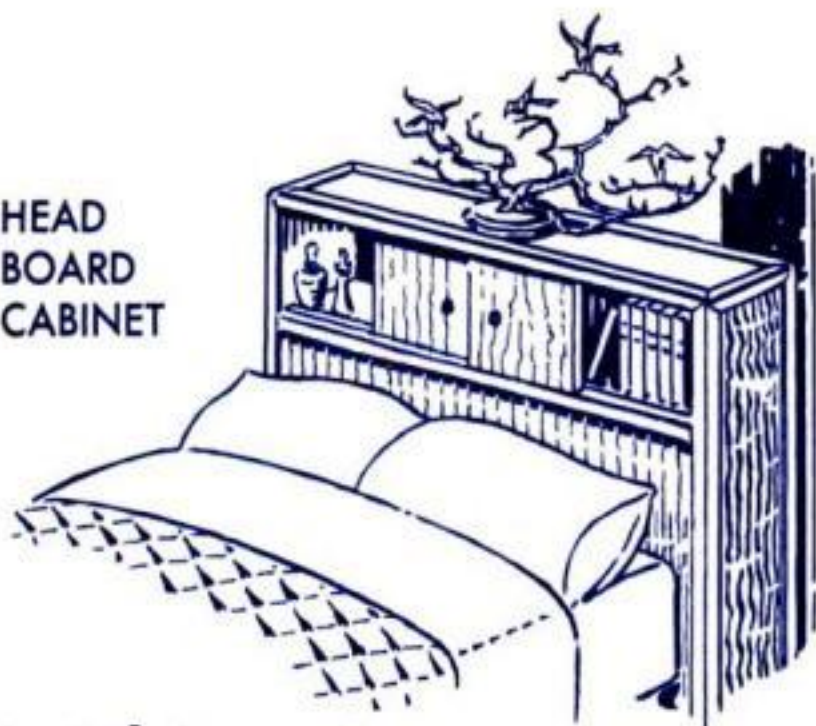
Jig speeds hole spotting. For quick and accurate corner post and "H" extrusion drilling, chuck a $\frac{1}{8}$ " bit in your Black & Decker drill and bore two holes the desired spacing apart in a short piece of Reynolds Aluminum angle. Butt this "jig" against flange angles and drill through the holes into the work stock. Then advance the jig one hole at a time, using a nail as a follow-up spacing pin.



ALUMINUM BOLT-AND-NUT ASSEMBLY



HEAD
BOARD
CABINET



Finishing tips

Painting and antiquing. Unless you use pre-finished paneling, it's best to disassemble parts for finishing. Don't overlook the potentials of your Black & Decker drill. A paint-mixing attachment chucked to its business end will save time on that chore. And a lamb's-wool polishing bonnet slipped over a rubber backup disk is fine for applying wax finishes. Because all faces of corner posts and "H" extrusions are finished to a high luster, they need no further treatment. For antiquing, apply

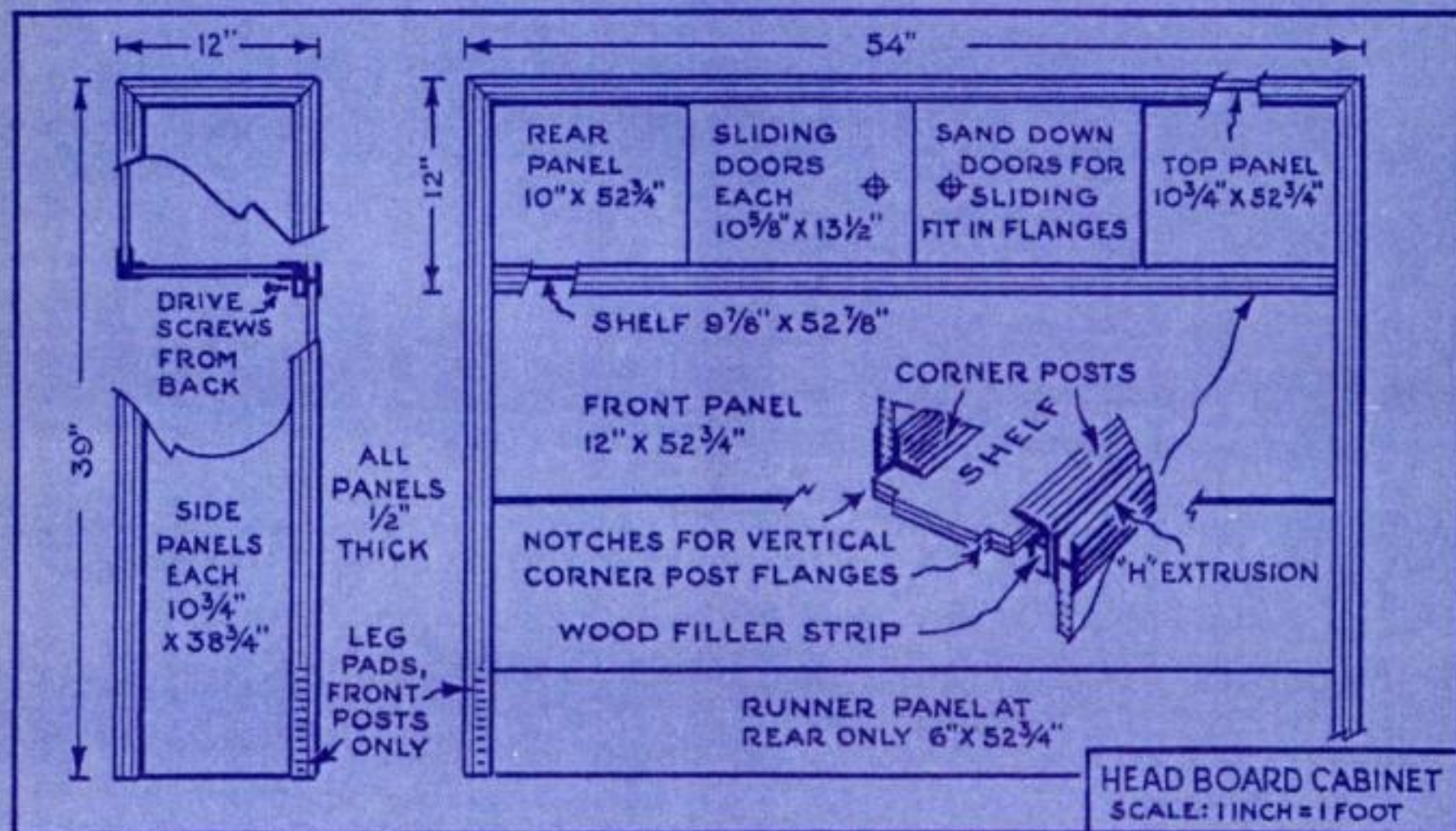
bronze enamel, then burnt umber wiped from fluting edges before it dries.

Booklets you'll want

Reynolds Metals offers three exciting Do-It-Yourself project booklets: "Bright Ideas," "Home Improvements Made Easy," and "Outdoor Projects," at 10¢ each. Address is Reynolds Metals Bldg., Richmond 18, Va. **Black & Decker's** big power tool catalog is free. Or enclose 25¢ for B&D's 182-page, fact-packed "How to Choose and Use Power Tools." Address: Black & Decker, Towson 4, Md.

CAUTION

The instructions in this booklet apply only to Reynolds Do-It-Yourself Aluminum—other aluminums might be harder and damage your hand and power tools.

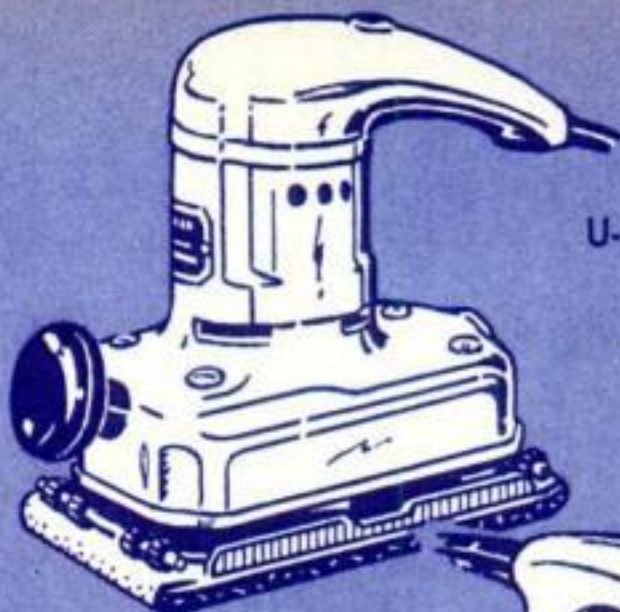


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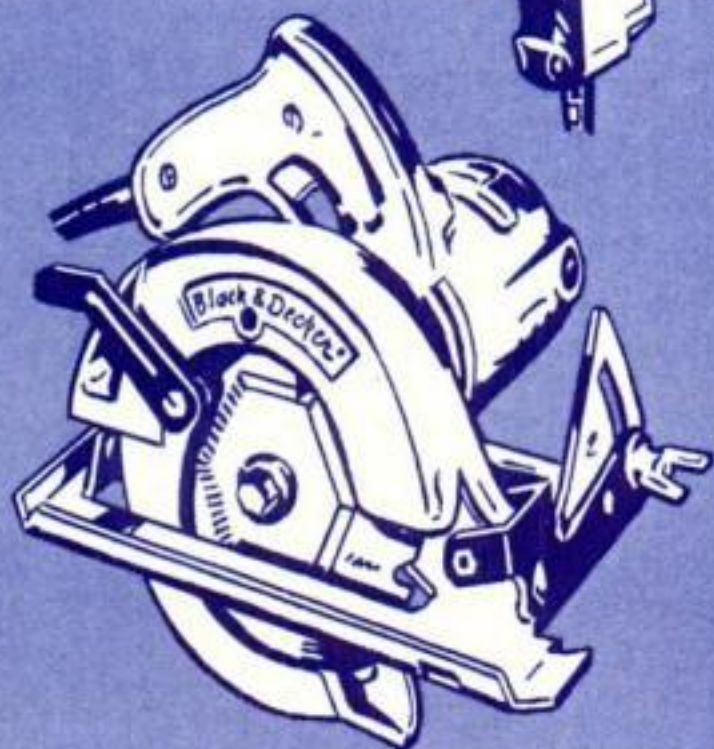
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PS BOATING

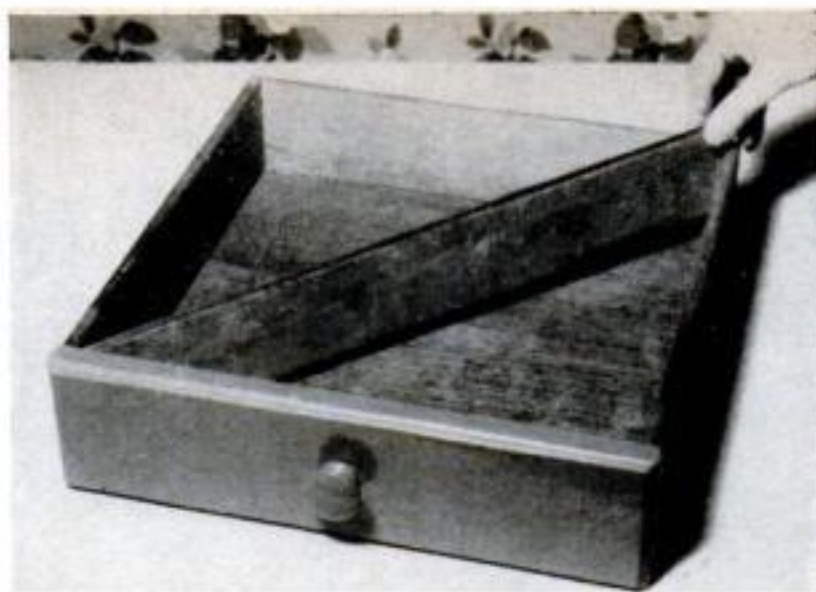


ON Lake Waconia, near Minneapolis, a fisherman in a boat about 60 yards away saw the boy stand up in the bow of a small boat to throw out an anchor. He was suddenly jerked overboard as the anchor line caught on his foot. Another boy dove in to rescue him. Both drowned.

Here's what:

Both boys were excellent swimmers, but with the weight of the anchor dragging him down, the first lad apparently exhausted himself trying to reach the surface. When the second boy got to him, he was either trapped in the drowning boy's grasp or died while attempting to free the boy's foot from the line.

Anchor lines should be kept neatly coiled, and anchor or mooring lines should never be cast with excess line underfoot. At best, you risk a bad rope burn. Secondly, the boy *stood up* to cast the anchor. Had he been seated, it's unlikely that he could have been pulled overboard by the weight of the anchor. Third, the natural inclination is to heave an anchor some distance from the boat. Good seamanship requires that it merely be dropped. Finally, the second boy probably could have raised his friend by hauling on the line. But few people choose the wisest course in an emergency.



Tricky way to divide a drawer in two

You can divide a drawer in half without nails, screws, or brackets. Guess how? A partition fitted diagonally between two corners will divide the drawer exactly in two and be self-securing. It lifts out for easy cleaning, too.—William Swallow, Brooklyn, N.Y.

▶▶▶ Old nailholes in corrugated metal roofing can be plugged with this trick I picked up from a Montana rancher. Pound lead BB shot into the holes. The soft lead conforms to the holes and makes a tight fit. A dab of roofing cement over each plug makes the seal watertight.—John Krill, North Lima, Ohio.



Put power tools on a pair of wheels

If your tool stands aren't fitted with casters, here's how you can turn them into mobile rigs by adding only two wheels. Weld a pair of large casters at right angles to the legs on one side. They should touch the floor but carry no weight. The tool can then be rolled, wheelbarrow style, yet be stable in use. Add diagonal braces of $\frac{3}{8}$ " rod as shown, and protect the wheels during welding with asbestos putty.—Ernest Mutch, Prince Edward Island, Canada.

People who live in green houses shouldn't use anything but Dutch Boy Latex House Paint.

And that goes for people who live in blue houses. And red houses. And houses in light, delicate colors like beige, or off-white. Why? Because Dutch Boy Latex House Paint holds its color. Stays fresh and bright.

The reason is this.

Dutch Boy Latex House Paint is made with exclusive 100% pure acrylic resins and permanent, light-proof pigments. And that means you get a paint job that's incredibly resistant to the three main causes of damage to paint. Moisture. Oxidization. And sunlight. Add this to the fact that, with this exclusive formulation, there's no chalking to mask the color and it's easy to see why Dutch Boy Latex House Paint really retains its color. In fact, it does it so well you can even come back and touch up years later and not see the difference.

Think what this means in maintenance. To keep your house looking good all the time you simply touch up the worn spots when they need it. In other words, you may never have to paint your whole house at one time again.

And color retention isn't all you get from this remarkable paint. Being latex, it brushes on more easily. Covers almost any surface—wood, stucco, even galvanized iron. You can stop when you like, start where you like, because it doesn't show lapmarks. It's quicker drying, too. You get a weathertight, bug-free coat in just a couple of hours. Brushes, equipment and people all clean up with soapy water.

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Call your Dutch Boy dealer. He has thirty new 1963 colors in stock right now. You'll find him in the Yellow Pages.



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fuel costs and its versatility as a trolling motor.

But she'll go! We had two Homelites tied to the stern of a small Powercat at Boynton. We slogged out the rolling Boynton Inlet and headed toward Europe with both throttles way forward. As we caromed from wave top to wave top, the motors passed the ultimate speed test: My teen-age son Jim was completely happy!

Dependability is another feature. The motors we used on several different boats at Boynton were the test motors that had been putting in eight hours a day at full throttle up and down the Intracoastal Waterway and out in the open ocean. They showed no signs of their hard work.

The Greenwich, Conn., police department operated a couple of Homelites in harbor patrols all summer last year. They used only one set of spark plugs—even with the considerable patrolling at idling speed, followed by swift runs to answer calls.

But you're probably about to say: "Look, isn't there any bad news? No machinery is that perfect."

And you're right. There are some disadvantages. One of them is weight. Though the Homelite has been on a fairly successful diet, it still weighs in at about the same for 55-hp. as some two-cycle motors do for 75. This is one reason why four-cycles never got off the ground when they were tried earlier—no one had ever used high-horsepower heavyweight motors. The idea of hanging 500 pounds of motor on the transom of a boat just hadn't occurred to anyone as a practice with much future.

Another drawback is first cost. Just as the 55-hp. Homelite weighs about as much as many 75s, it also costs almost as much. But look what you get for your money.

There are a lot of built-in features that are appropriate to the cost and weight of the motor, and work well. Every motor is equipped with a built-in alternator. It has dual carburetors with fixed high-speed jets. The exhaust is always discharged underwater, even while idling. The reverse lock lets you throw the motor into reverse without danger of it kicking up, but is impact-loaded to release instantly if you hit something solid while moving forward.

Oil-pressure system. Lubrication is handled by a high-pressure system operating from the two-quart oil sump. Oil (#30

for summer conditions) is distributed to all bearings through internal passages. Since this separate pressurized oil system is one of the major differences in this engine, I took particular pains to dig out the dope on just how it works. Here goes: A sump in the lower leg stores the oil until it is ready to be used. A positive-displacement gear-type pump draws it up from the sump and forces it through special tubes cast into the crankcase. Next stop is the oil filter, an inexpensive throwaway type. (A pressure-regulator relief valve on the engine side of the filter maintains constant pressure for proper lubrication at any engine speed.) From the filter, the oil passes through drilled holes directly to the main and connecting-rod bearings, and is thrown off these points to lubricate cylinder walls and wrist-pin bearings. At the same time, it is fed into the hollow tower shaft, lubricating the tower-shaft bearings. Next it enters a passage in the center of the camshaft. Holes in the camshaft journal allow oil to be fed directly to the bearing. Finally it returns to the sump to start the whole thing over again. The oil-pressure switch is connected to the safety warning horn and light on the remote-control box.

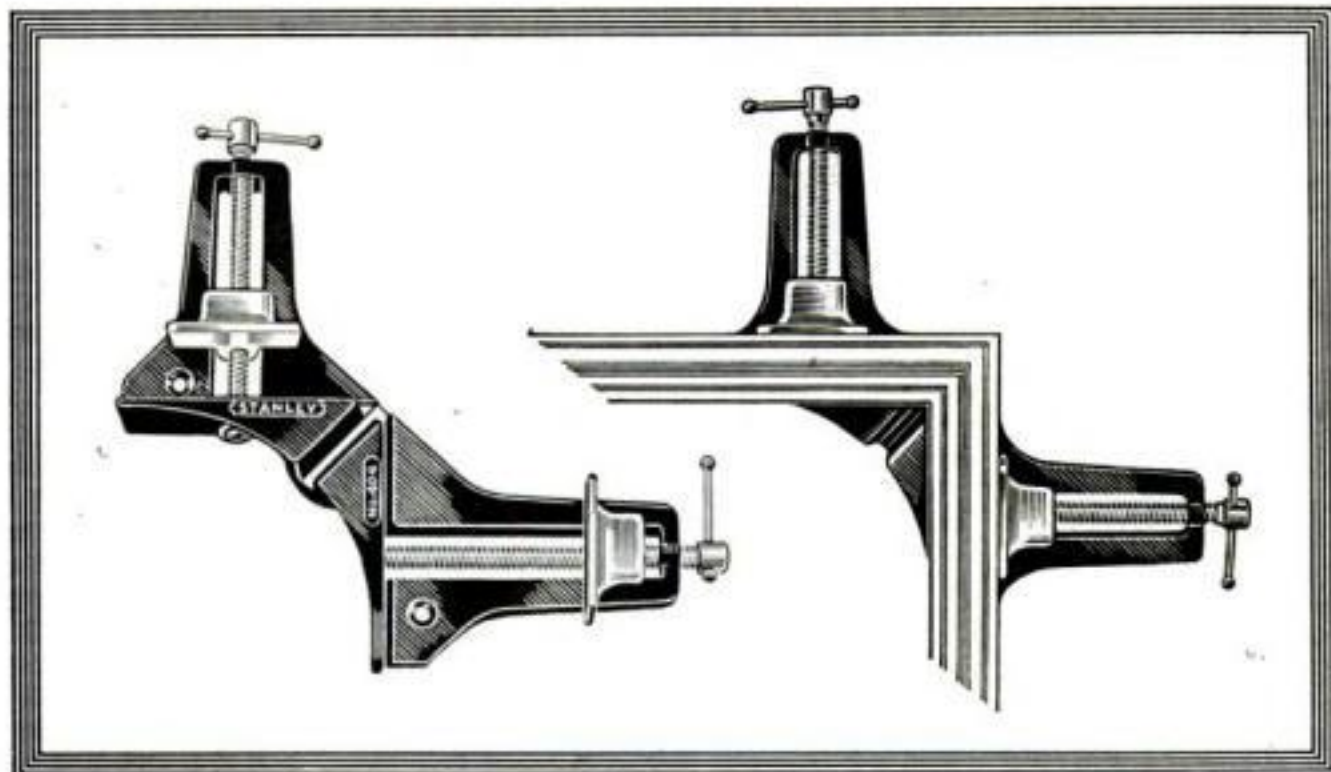
Handy control system. A lot of good thinking has gone into the control system. Standard is a single-lever unit with lots of built-ins. The starting key is built into the rear of the unit, eliminating separate wiring and mounting on the dash. All I had to do to fire up was set the warmup lever, turn the key, and push it in a bit to actuate the Man-u-Matic choke system. This warmup lever can be set for hot or cold conditions—the punch-key choke then supplies just the right air-gas mixture. Another built-in in the control unit is an audio-visual alarm. If the motor overheats or the oil pressure drops, a red light flashes, and a horn beeps.

Homelites are now available throughout the country. They were first introduced in the Florida area in 1961, so some owners are now using them for the third season. In 1962 the motor was offered to boatmen in the New York area and in the Pacific Northwest. This past spring, distribution was made general over the country.

So now, if you want to make your own test of the automotive-type engine that you hang in the back of a boat, it's ready and waiting. ■ ■

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MITRE CORNER CLAMP—Perfect tool for picture frame joints and screens. Clamps securely to fully expose both sides of the joint. Insures successful 90° joining with glue and nails. No. 404.

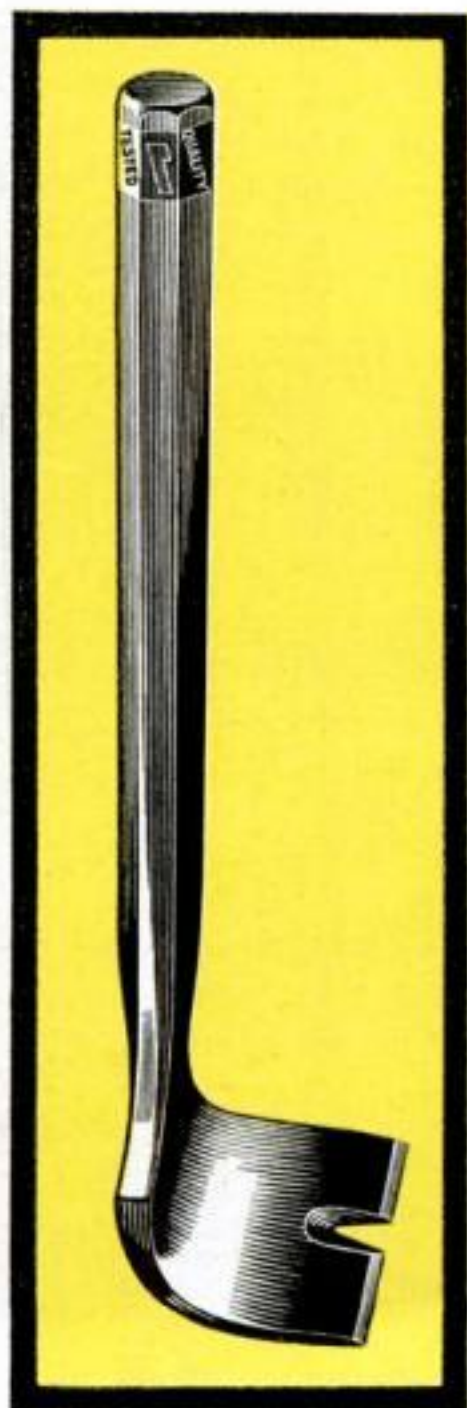
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example. Prices run about 35 to 50 cents for the fiberboard system, uninstalled; higher for the plastic-panel system.

Floors. Three new developments, all involving plastics, have broken into the market this year. First (by Stylon) is a 12"-by-12" tile, composed of 1"-square ceramic tiles grouted and underlaid with vinyl. Install it with mastic, as you would a resilient tile. About \$1 a square foot. A second entry (by Armstrong and American Biltrite) is made of Hypalon, and is said to have wearing qualities superior to vinyl. These will cost you up to \$2 a square foot, installed. The third (by Weirmar) is made up of marble chips set in plastic, and is also installed with adhesive. From \$1.25 to \$2.25 a square foot.

Walls. You can install walnut paneling for less today. At about 23 cents a square foot, the new plastic-coated hardboards offer a wide range of wood tones. One firm (Evans Products) has even produced a textured hardboard that not only looks like wood, but feels like wood. Newest type: a higher-priced panel of flakeboard with a lamination of melamine (Formica).

Room dividers. Take a trip to your building-materials dealer and look over the new crop of aluminum, hardboard, and plastic dividers. There's quite a selection. Cost: as low as \$12 for a 26"-by-96" unit.

Manufacturers who make the products:

PVC Siding. Monsanto Chemical Co., 800 N. Lindbergh Blvd., St. Louis 66; Mastic Corp., South Bend, Ind.; Dura-Lok Div., Acorn Chemical Co., 8203 Franklin Blvd., Cleveland.

Plywood siding—plastic-finished. U.S. Plywood Corp., 55 W. 44 St., NYC 36; Georgia-Pacific Corp., Portland, Ore.

Aluminum siding—plastic finished. Alsco, 225 S. Forge, Box 270, Akron 8, Ohio.

Hardboard siding—plastic finished. Masonite Corp., 29 N. Wacker Dr., Chicago 6.

Tedlar-coated acrylic panels. Filon Corp., 333 N. Van Ness Ave., Hawthorne, Calif.; Structoglas, 11710 Shaker Blvd., Cleveland.

Vinyl step-down panels. Barrett Div., Allied Chemical Co., 40 Rector St., NYC 6.

Alkyd-aluminum roof paint. Sapolin Paints, Inc., 205 E. 42 St., NYC 17.

Vinyl surfaced gypsum board. National Gypsum Co., Buffalo 2, N.Y.

Vinyl sash window. Malta Mfg. Co., 120 Mill St., Gahanna, Ohio.

Plastic window sill. Woodall Industries, Inc., 3502 Oakton St., Skokie, Ill.

Epoxy basement sealer. Boyle-Midway, Inc., 22 E. 40 St., NYC.

Glass block. Pittsburgh-Corning Corp., 1 Gateway Center, Pittsburgh 22.

Plastic ceiling systems. Medart Engineering & Equipment Co., 1211 Hadley St., St. Louis 6; Emerson Electric Mfg. Co., 8100 Florissant Ave., St. Louis 36; Filon Corp., 333 N. Van Ness Ave., Hawthorne, Calif.; Arterest Products Co., 255 W. 79 St., Chicago 20; Alsynite, White Plains, N.Y.; Sears, Roebuck, Chicago 7; Dow Chemical Co., Midland, Mich.

Fiberboard ceiling systems. Celotex Corp., 120 S. LaSalle St., Chicago 3; Armstrong Cork Co., Lancaster, Pa.; Repco, Inc., 1067 E. Grand St., Elizabeth, N.J.

Floors. (Ceramic in vinyl) Stylon Corp., Milford, Mass.; (Hypalon) Armstrong Cork Co., Lancaster, Pa.; American Biltrite Rubber Co., Trenton, N.J.; (marble in plastic) Weirmar, 1154 Hanna Bldg., Cleveland 15.

Room dividers. Panelboard Mfg. Co., 222 Pacific St., Newark 14, N.J.; Meta-Mold Aluminum Co., Cedarburgh, Wis.

Walls. (Textured hardboard) Evans Products Co., Corvallis, Ore.; (melamine panel) Formica Co., Cincinnati 32. ■ ■

Pushbutton track worker



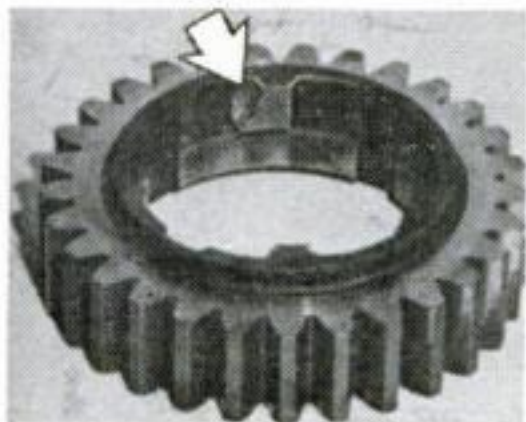
Multiple vibrating feet on the rail car above pack ballast around tracks and ties so firmly that it resembles a mosaic floor. The diesel-driven tamper, made by Jackson Vibrators of Ludington, Mich., develops a vertical force of 7,160 pounds, a horizontal force of 2,130 pounds. It's operated with pushbuttons by one man.

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The internal driving lugs of the oil pump wear in this manner.

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How to Make a Living-Room Rifle Range

[Continued from page 148]

or at some object about 10' or 12' away.

This part of the job takes some doing because the lenses you get probably will not be exactly the same as those I used. So you will have to experiment to find the best relative placement of the lamp and lenses. Mount the lamp socket with a small tack so that it can be moved if necessary.

As a starting point, place the 15mm lens in the barrel and position it about 7" from the lamp. Then, place the 21mm lens about 3" from the 15mm lens. Fire the lamp and view the resultant light on an object 10' or 12' away. Experiment with the placement of the lenses, moving first one and then the other until you find a position at which the light is focused to a small spot. Once you find the best placement, cement the lenses in position with epoxy cement.

Before the cement is firmly set, make sure that the spot's shape did not change when the cement was applied. Also, at this time, sight down the barrel and see that the spot is hitting where the barrel points. The position of the lamp in respect to the lenses will determine the pointing error. By moving the lamp up and down, right and left, any pointing errors can be removed. After the lenses are set rigidly, cement the lens cover in place.

Accurate sights are essential. I visited several gun shops and finally located a rear sight for less than a dollar. The least expensive front sight available cost several dollars. So I used a 4/40 screw.

Assemble the target circuitry on a 3"-by-2½" piece of perforated Vectorbord. Leave the transistors off while you're wiring their sockets; heat from the soldering iron will damage them. And watch the polarity of the capacitors.

To test the target circuit when it's complete, temporarily join the leads on the photocell to the proper leads from the target circuit. Install the 30-volt battery in its holder and place the transistors in their sockets. (Don't mix them—one is a PNP and the other an NPN.) Wire in the Off-On toggle switch and the bell gong plus its battery.

Turn on the toggle switch, point a flashlight, or the rifle, at the photocell and flash it on and off rapidly. Each time the light is turned on, the bell should ring.

The target circuit is a cadmium sulfide photocell and a two-transistor amplifier.

The photocell and a 12,000-ohm resistor are connected in series across the 30-volt battery. Cadmium sulfide photocells are essentially variable resistors; their resistance decreases as light on the photosensitive surface is increased, and vice versa. When high-intensity light from the rifle hits the photocell, its resistance goes down and more of the voltage from the 30-volt battery is dropped across the 12,000-ohm resistor. This voltage increase is coupled through capacitor C1 to the base of transistor Q1. The voltage change is amplified by Q1 and Q2, and the relay is operated.

When the target circuit is turned on in any lighted area, the bell will ring, perhaps for a second or two depending on the amount of light. In direct sunlight, for instance, the resistance of the photocell will be so small that the light from the rifle will not cause a sufficient voltage change to ring the bell.

For the target cabinet, cut two 7"-by-9½" pieces of ¼" plywood for the front and back panels, two 7"-by-10" pieces for the sides, and two 7"-by-7½" pieces for the top and bottom. Four ½"-square strips, 3¼" long, strengthen the corners.

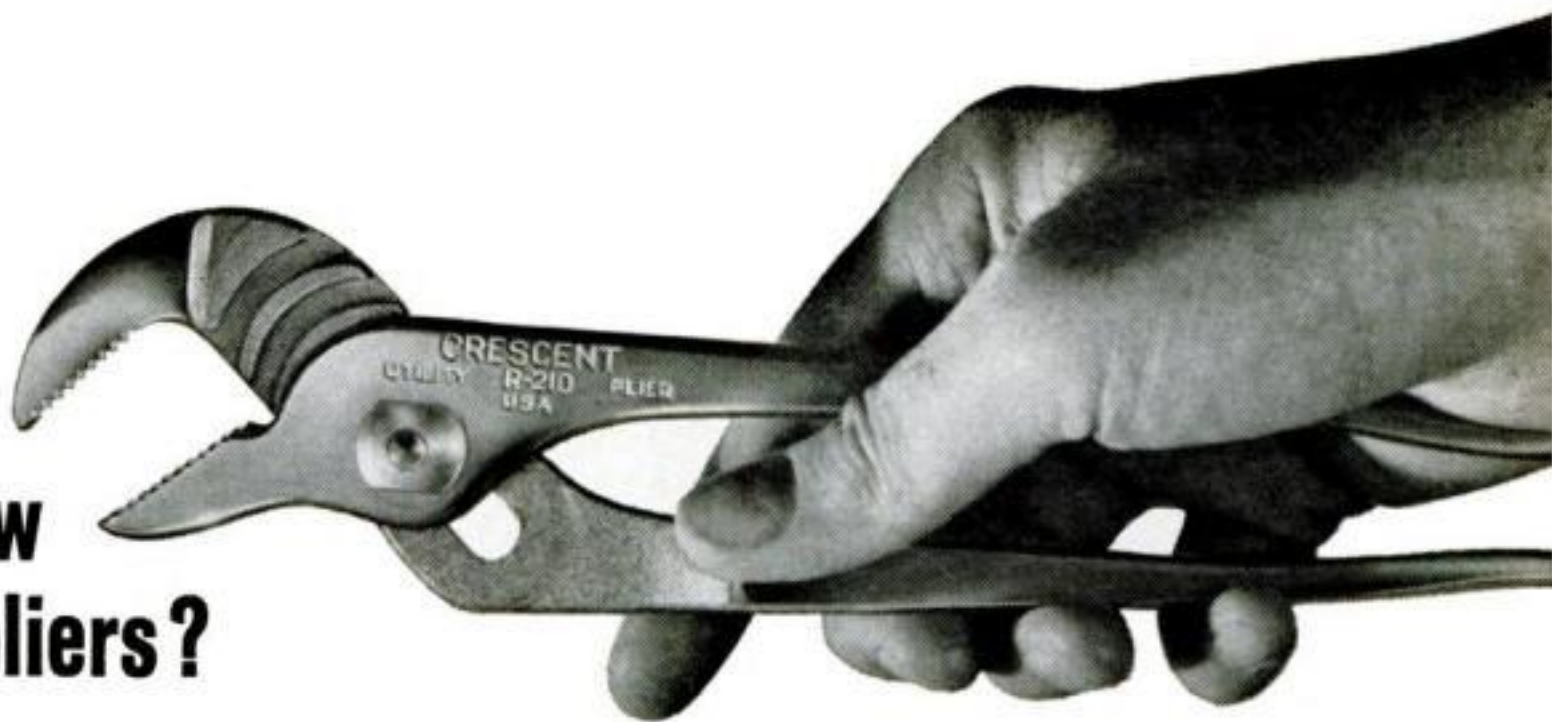
Assemble the cabinet temporarily around the front and back panels. Glue a standard 7"-by-9" rifle target to the front panel and drill two small holes ¼" apart in the bull's-eye. Fasten a two-lug terminal strip to the back of this panel, near the two holes. Disconnect the photocell from the target circuit, run the leads through the two holes, and solder them to the terminal strip. A few drops of glue will hold the photocell in place. Drill a ½" hole in the side of the target cabinet for the Off-On toggle switch. Now paint the cabinet dull black.

Mount the target circuit, bell, and batteries on the back panel. Push the front panel into the cabinet and solder the leads from the target circuit to the photocell terminal strip. Mount the Off-On switch and put in the back panel.

The unit is now ready to operate. Just turn on the target and fire away. As has been pointed out earlier, the unit operates better if not exposed to very strong light. So for best results turn the target away from direct sunlight or the light from a large lamp. Other than this, there are no gimmicks or precautions to be observed.

Happy shooting. ■ ■

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"But my personal feeling is that the most important change has already begun—in education. School children growing up now take for granted that man will travel throughout the solar system. The impetus that the space program has given to all science—from astronomy to zoology—the way it has changed the content of textbooks and lifted man's intellectual horizons—these are the things that count in the long run."

"But couldn't we do all this at less cost by concentrating on instruments alone? Do we really need men in space?"

"A large portion of NASA research does involve instruments alone. Take the Mariner II Venus probe, for example. It showed that man could maintain radio contact up to a point 53.9 million miles from earth. This is truly remarkable since the transmitter on board had only three watts of power—about enough for the parking lights of an automobile.

"Another instrument-only package confirmed the existence of a helium layer in the atmosphere. And still another went far to disprove one of the two rival theories of the creation of the universe—the 'steady-state' theory, which asserts that matter and antimatter are being continuously created throughout the universe.

"Work like this is a vital part of the space program. It will continue as we launch more orbiting observatories and planetary probes. Many of these tools work in environments that might be dangerous to man. In fact, part of their function is to describe what the dangers may be.

"Yet these unmanned probes are ultimately limited. Suppose the instruments designed to test for life on Mars came back with negative data. You'd never know if this was because of an instrument failure, or if the probe came to rest on a 'dead' area, or what. . . . Man is needed as an observer, a repairman, and a judge—skills that Project Mercury has amply demonstrated.

"The Manned Lunar Landing Program has been criticized as 'unscientific'—when in fact NASA has never considered it primarily a science mission, in the sense that an orbiting telescope is. It is an engineering feat that will require a broad range of mechanical, chemical, electronic, and other skills, and undoubtedly will raise multi-

tudes of theoretical questions along the way.

"The Manned Lunar Landing Program brings into existence large rockets, test and launch stands, techniques such as rendezvous and docking, and trained people to enable the U.S. to do what it wants in the space between the earth and the moon."

"What are the main problems in putting a man on the moon?"

"The first, by far most important, consideration is reliability. Every stage of the project from launch to lunar orbit to landing, rendezvous, and return must have maximum reliability in command, control, and backup systems to insure the safety of the astronauts.

"This was one of the main reasons for the choice of the lunar-orbiting rendezvous system over the earth-orbiting plan. Many people argued that earth-orbiting rendezvous was safer—but they ignored the overall safety of the mission.

"A second problem is radiation, a hazard that must be dealt with in terms of shielding, course selection, timing, and so on.

"The third problem, or problems, involves the design of the vehicles—the capsule, the lunar exploratory module—all the major mechanical and aerodynamic problems that must be solved."

"How does the schedule look now?"

"The major steps will begin with a Saturn launching of a model of the Apollo capsule in late '63 or early '64. The schedule for the first unmanned launch of Gemini is about the same, with rendezvous flights planned for 1965. That year will also see the earth orbiting of the Apollo command-and-service module. The lunar landing itself should take place before 1970."

"And if Congress cuts your budget?"

"We will do everything to keep Project Apollo as close to schedule as possible, consistent with a properly balanced effort."

"What will happen to projects like the rocket plane, for example?"

"That's one that I would not like to see dropped. The X-20 Dyna-soar plane has a degree of maneuverability no Gemini vehicle can ever attain. You could bring an X-20 down on any part of a surface as large as the United States. With the Gemini, you're

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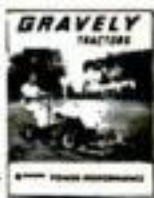
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Why the Moon Is a Must
limited to a radius of the order of one or two hundred miles."

"That would have a decided military advantage would it not? How do you separate the military aspects of the space program from the 'peaceful'?"

"The technology is the same, but the applications are different. The problems of designing boosters, of building better tracking and guidance systems, are the same whether the payload is a nuclear warhead or a vehicle for scientific purposes."

"How does that affect cooperation with the Russians?"

"I doubt whether the Russians will ever cooperate on a manned space flight. That phase of their program is completely under military control. Of course, we have worked out agreements with them on weather satellites and satellites for measurement of the earth's magnetic field. However, there are difficulties here, too: We would like to exchange raw data without corrections. The Russians say no. They're not anxious to let us know how good their data-acquisition and tracking systems are."

"What will happen if the Russians do get to the moon first?"

"That won't stop us! Space exploration is a big and continuing job."

"And after the moon, what?"

"I personally believe that the next major program will not be an extended exploration of the moon or its use as a base for planetary exploring. I think, rather, that we will launch a space station designed to enable several men, including scientists, to orbit the earth for as long as a year. The orbit will be set around three hundred miles, high enough to escape atmospheric drag, but low enough to avoid the more dangerous radiation belts. The craft itself can be designed for a number of intrinsic experiments: medical or biological studies of man, plants, and animals under long-term weightless conditions; to provide a way-station (and the most economical one) for launching other spacecraft; to perform experiments in weather or communications; or it could be used for practicing rendezvous and docking techniques and other kinds of maneuvers that should logically precede any extended space travel."

example, but one tracked at less force than the other, the lighter one got the nod. In a few cases where clearly excessive force was necessary to make a cartridge track, it was disqualified.

Turntables. Easiest component of all to judge is the turntable. A special test record makes flutter and wow easy to hear. Tables with too much rumble—the noise of the drive motor picked up by the cartridge and reproduced through the speaker—were thrown out, as were those with easily audible wow and flutter, or a speed variation of greater than 3/10 of one percent. Those remaining were judged against one another on the basis of price and operating convenience.

Listening. Each member of the panel did his listening individually. It was done "blind." A judge did not know the brand name of any equipment when he was listening to it. A variety of records was played during the selection of each component. Individual components showed differences on some records that were not apparent on others.

While many different records were used, depending somewhat on the taste of the individual judge, the following were selected as a minimum "must" group to be used at least once by each panelist for every component tested. The main reason for the choice is given after each record:

- Joan Baez in Concert; Vanguard VSD-2122. Excellent-quality individual voice and guitar recording.

- Chopin, Concerto No. 1; Artur Rubinstein; Victor LSC-2575. Excellent piano tone.

- Gus Farney at the Giant Five Manual Wurlitzer Pipe Organ; Warner Brothers WS 1409. Full organ tone.

- Mahler, Symphony No. 1; Bruno Walter; Columbia MS 6394. Brilliant, clean, full orchestral sound.

- Rossini Overtures; Pierino Gamba; London CS 6204. Startlingly realistic stereo sound, unusually clean percussion and string sounds.

- Juan Serrano; Ole, LaMano!; Elektra EKS-7227. Good guitar tone, useful for checking speaker coloring.

- Igor Stravinsky Conducts; Columbia MS 6272. Very good definition of wind-instrument ensemble.

- Virgil Thompson, The Plow that Broke

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The Low-Down on Hi-Fi Stereo

the Plains; Vanguard VSD-2095. Big, beautiful, massed strings and brass sounds.

● Wagner, Highlights from Das Rheingold; London OS 25126. Huge, overpowering orchestral and vocal sounds recorded in brilliant stereo. Prolonged high-level passages show up overloads in system.

When all of the results were in, the individual choices of equipment were correlated. There were some differences, of course, but there was a surprising unanimity overall. Even minor differences were subjected to further listening tests until all doubts were resolved.

With final results tabulated, the biggest surprise was the price tag on the low-priced system. You can acquire a really creditable stereo record-playing system for nearly \$100 less than experts usually quote as a minimum—if you pick the right units. But the less you pay, the trickier it becomes to mix and match components effectively.

Here's the story on each system, with some suggestions to help you decide which is best for you:

System I, the economy system. This was the toughest of all systems to choose.

The panel was challenged, originally, to

find a system for under \$100 that they could conscientiously recommend. All six of the panelists, with broad experience in hi-fi equipment, were sure it couldn't be done. As it turned out, they were right. But they came closer than any thought they would. There were a number of possible combinations that added up to \$100 or less. But not one member of the jury would accept any of the systems. The closest they could come to the target price was \$108.46—and even that required the buyer to build an amplifier from a kit and make his own mount for the record changer.

To show how successful the choices are: A prominent hi-fi expert, called in to double-check the panel's choice, guessed the cost at about \$300 when he listened to the system without knowing its components.

System II, the music-lover's system. This system was designed for the person who is serious about his music listening and is willing to spend as much as is necessary to get top-quality sound—but no more.

There is more equipment on the market that would fit into this system than in either of the others. Choosing required careful weighing of cost against quality of sound

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The Low-Down on Hi-Fi Stereo

produced. No component found its way into this system if there was a cheaper one that sounded as good. For example, there are a number of well-known amplifiers that sounded just as good as the Eico ST-40 selected, but it was the cheapest one that met the panel's critical standards.

System III, the hi-fi hobbyist's system. This is almost (but not quite) a money-is-no-object system.

Where there was a more-expensive component that produced a detectable improvement in sound, it was chosen—even though it might take careful and extensive listening to notice the difference. The panel, though, still insisted on finding the best value for your money. The record changer is an example. For listening, the designated Garrard A MK II was indistinguishable from the Dual 1006 Custom. But the generally advertised price of the Garrard is somewhat lower. Prices vary, however, and dealers often feature specials. If you can find the Dual at the same or a lower price, there is no reason not to buy it if you like its convenience features better.

Regardless of the system you choose, we recommend buying two accessories: a

stylus-force gauge and a gadget called a Dust Bug for keeping your records clean.

Don't let the technicalities of setting up a component system scare you. Your dealer will supply all the connectors you need and show you exactly how to put it together. It's no more complicated than plugging in a floor lamp.

When you get the system in your listening room, experiment with various locations for your speakers. You'll be surprised how much difference moving a speaker just a few feet will make in the sound you hear.

Although you should have no trouble hooking up your system, a detailed guide, written in nontechnical language, will help you find more pleasure in it. You can learn smart tricks for setting up equipment, finding and fixing minor troubles, and adjusting the system for best possible performance. There are many such books on the market. Two of the best are: *High-Fidelity Systems, a User's Guide*, by Roy F. Allison (\$1 by mail from Acoustic Research, Inc., 24 Thorn-dike St., Cambridge 41, Mass.), and *Hi-Fi Made Easy*, by Norman H. Crowhurst, (paperback book available at bookstores and electronic-supply houses. \$2.90). ■ ■

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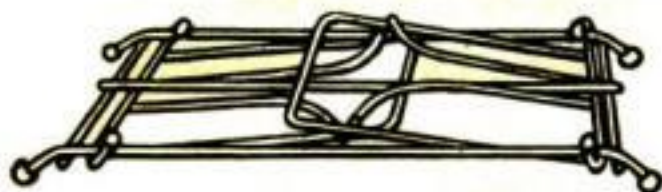
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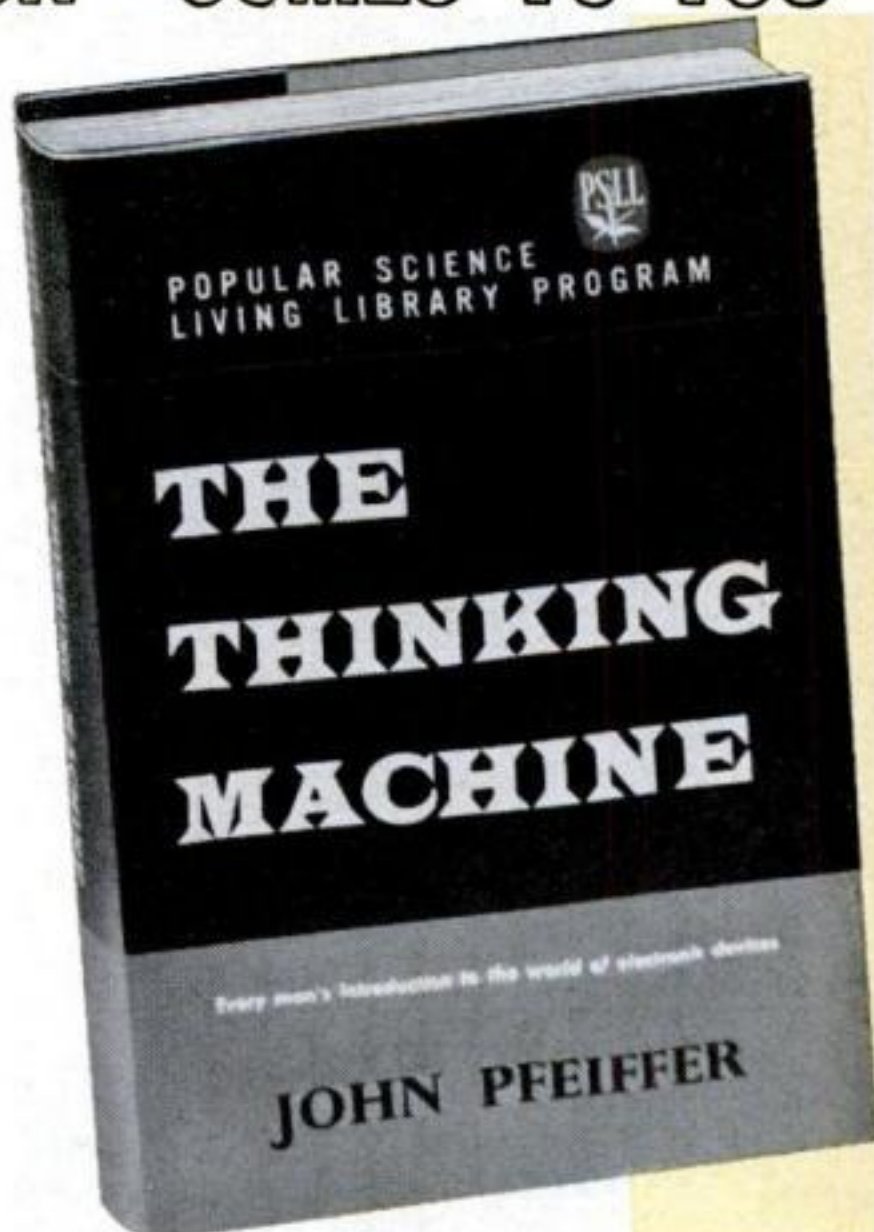
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The tread compounds—or polymers, as the engineers call them—in racing tires vary greatly. They are softest of all on dirt tracks where the wear is less. They are hardest for asphalt's sharp turns. They are softer for the big ovals with long, well-banked turns than they are for the smaller ones where tires smoke in the corners.

Tires for the shallow-banked Indianapolis track have to be a compromise to give a driver maximum wear, yet provide enough adhesion. The goal in sports-car tire engineering is traction.

Compounding is the tire industry's best-kept secret. Besides adhesion and wear, it has another function—to keep down heat caused by tire scuffing and flexing.

Tire compounds must be tailored to both track and car. In 1961, Firestone sent driver Eddie Sachs to the new Atlanta Raceway to test its regular Indianapolis-type tires. Sachs and the Firestone engineers found Atlanta's grueling asphalt turns were causing tires to run dangerously hot—over 300 degrees. The race was only 10 days away and over 20,000 tickets had been sold, but the Firestone people shook their heads. They weren't going to let anybody race with those tires on that track. They *could* make tires that would run cool at Atlanta, but not in 10 days. The race was called off.

More natural rubber is used in racing tires. It runs cooler. But gradually more artificial rubber—today, a substance called polybutadiene, a petroleum derivative known by various trade names—is being introduced. It replaces an earlier artificial rubber called styrene-butadiene, now the chief ingredient of standard tires, which got its first tests on the race track.

Riding on a bed of rubber. Treads for oval racing are designed for adhesion in the turns. An asphalt driver is not necessarily in immediate trouble when his tread is gone. Smooth tires will still provide adhesion if the track is dry, largely because the dozens of cars participating have laid down a scuffed-off bed of rubber on the turns.

But a driver who doesn't scat to the pit

From Track to Turnpike

with smooth tires when rain slicks the track and washes the rubber off is inviting trouble.

Aside from refueling, tire changes are the chief reason for pit stops in a race. Some drivers go so far as to spray silver paint on the rubber at the tread base so they can watch the tire more closely. When the silver begins showing, it's time to re-tire. Lee Petty of Randleman, N. C., is the best-known practitioner of this.

Tires for land speed-record runs have no tread at all. When Mickey Thompson of Long Beach, Calif., drove his Challenger I at the Bonneville Salt Flats 406.6 m.p.h. in 1960 for the fastest automobile measured mile in history, his Goodyear tires were as bald as doorknobs. Centrifugal force would have thrown any tread.

Heat is the racing tire's biggest bugaboo. It causes blowouts. The safe operating temperature is under 300 degrees F., and 250-260 degrees is more desirable. When tires smoke in the turns, they are generating, for a brief moment, from 500 to 600 degrees. At that temperature, even iron will begin to glow.

Temperature readings are taken at both shoulders and at the center of the tread. Tire engineers are fussy about this. Goodyear, for example, insists on a spread of less than 50 degrees between shoulders. Besides showing how tire composition is faring, these readings tell whether front-wheel caster and camber are off.

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Stock-racing tire dwarfs passenger tire at left. Racing tire has wider tread, shallower grooves; pressures run about 40 to 60 p.s.i.

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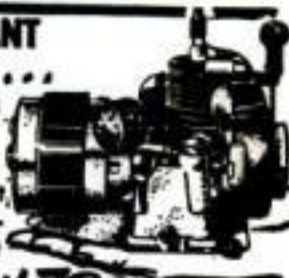
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The engineering of racing-tire bodies—the fabrics—is the tire companies' next best-kept secret. They use nylon cord, instead of the rayon most commonly used in standard tires, because it's tougher. The diameter of one typical nylon racing thread is .021 inch as against .026 in rayon.

Angling the cord. It's the number of cords per inch and how they are processed that Firestone and Goodyear are most chary about disclosing. They also guard zealously the "bias angle" that the cords assume in the tire. That means the angle of the cord in relation to the direction of tire travel. Cords laid in the same plane as the tire rim would have zero angle; laid crosswise, they would have a 90-degree, or maximum, angle. The smaller the angle, the longer the cords, the less stress there is in flexing, the less the effect of centrifugal forces, the cooler-running the tire.

But the smaller the angle, the harsher the ride. This is why passenger-car tires have to be a compromise. Their bias angle is greater than that in racing tires.

Racing tires differ in yet another way. The number of cords per inch in their bodies is higher on the inside plies, decreasing toward the tread. This provides more rubber toward the tire perimeter and lessens the chance of throwing off tread at high speed.

The race-track laboratories are providing better tires, with better bead designs and better adhesion, both for the race driver and the ordinary motorist. At the Darlington, S. C., oval, only 1½ miles around, speeds on the straightaways five years ago ran 115 m.p.h. Now they are up to 130. At Daytona only four years ago straightaway speeds were 150. Now drivers are turning whole laps—turns and all—at 168, and yet a careful driver can go the entire 500 miles on one set of shoes. Lund did just that last February, and that's what won the race for him. At Indianapolis, while engines have remained practically the same, the speed of the winner has increased 14 m.p.h. in the last 10 years.

What's in it for you? For 1964, here is what the race-track laboratory will do for passenger car tires:

- Reduce the cord bias angle for longer wear without stiffening the ride.
- Produce even better compounds and tougher treads, with better adhesion.
- Reduce heat.

- Produce better insulation at the bead to keep the wires intact under stress.

- Permit squattier, "low-profile" tires, safer because they offer more footprint to the road.

- Improve the two-ply (two layers of cords) tires that gradually are replacing four-plys. While they are just as tough as four-plys because the cords are thicker, they give a softer ride and run cooler.

(Racing cars don't run on two-plys or even four-plys. Frequently their tires have six or more plies to stiffen the structure. But the lessons learned by the engineers from studying cords subjected to the brutalities of the race track led directly to the design of the two-ply.)

Standard passenger-car tires had to get better these last few years. Heavier cars, smaller wheels, higher horsepowers, higher speeds, and consequently higher tire temperatures forced tire engineering changes.

On the race track, the competition between Firestone and Goodyear is fierce. Until 1959 Firestone had had a monopoly in racing tires for almost a half-century, except for some sporadic entries by a few other companies, including Goodyear. Firestone today remains the most famous name in racing rubber. But four years ago, Goodyear, the world's biggest rubber company, entered racing with a vengeance. It has vowed to run rubber at Indianapolis, long Firestone's private preserve, next year.

An incident at Atlanta's 500-mile stock-car race last March was a token of the nature of the competition. A torrential rain that delayed the race an hour had washed the track clean of rubber "laid down" in practice, greatly affecting handling on the turns. Using tire chalk, Fred Lorenzen, at the wheel of his Ford, wrote "GOODYEAR" on his left front window as he whizzed by his pit on his 142nd lap of the mile-and-a-half course. On his next time around he rolled in to switch from his Firestone shoes on the right side. On the next lap he stopped to switch his left tires, too, to Goodyears.

Lorenzen was quoted as saying that he needed better adhesion than the Firestones were giving him. The Firestone people later said that there wasn't a thing wrong with the shoes Lorenzen discarded.

Petrasek's Law. If Firestone currently is the most famous name in racing rubber, so is Steve Petrasek the most famous Akron figure in the pits. Novice drivers—those

From Track to Turnpike

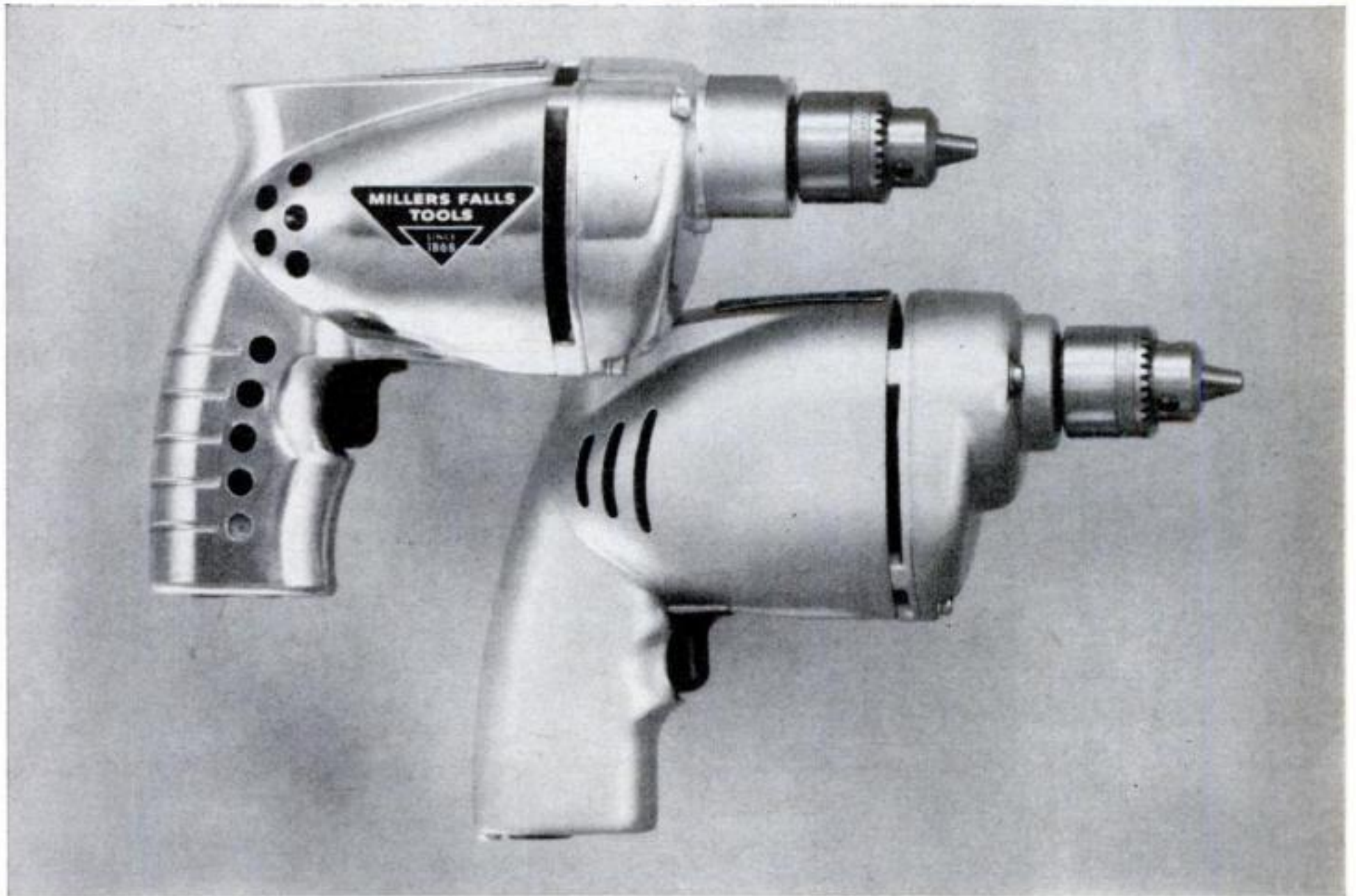
who have never driven Indianapolis before—must attend a pre-race lecture he gives, by fiat of the race management. A lot of the old heads show up, too. Here he lays down what might be called Petrasek's Law:

"Your grooves will disappear progressively. As you reach the last one, you'll have 10 to 12 laps left. You will soon be through your tread rubber and will hit a dark, black, heat-resistant rubber. This insulates the nylon cord. It's not a wearing rubber. It can be seen for from three-quarters to 1½ laps. Then your tire will look as though it

needs a shave as these pieces of rubber begin breaking off. After three-quarters of a lap you will see the beige-brown nylon fabric. If you don't roll in at that point, we'll have to come and get you."

Petrasek has, himself, driven a car 200 miles an hour on the Utah salt flats, and last February was burned badly in helping to pull driver Marvin Panch from a Ford-powered Maserati that caught fire during a time trial at Daytona.

Petrasek and Wasko, his opposite number at Goodyear, are that devoted to racing. ■ ■



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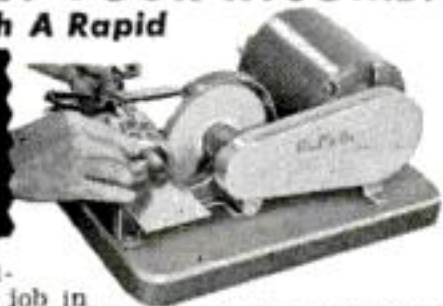
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Do Lie Detectors Lie? [Continued from page 67]

He gave the examiner no reactions to read and so it was prematurely concluded that he was truthful.

Yet under later questioning, he admitted that he had been lying. He finally confessed that *he*—not the two men he was to testify against—was the murderer.

On the other hand, the polygraph, used properly, has yielded astonishing results.

One of the most dramatic instances was the Army Criminal Investigation Division's success in detecting deception and in securing a confession from Col. Jack Durant and Mrs. Durant that, while on occupation duty after World War II, they stole the crown jewels of the Duchy of Hesse. On another equally memorable occasion, Leonarde Keeler employed the polygraph technique to put his hands on eight Nazi POWs who had beaten a fellow-prisoner to death.

Freeing the innocent. Credit must also be given the polygraph in the case of a young woman who accused a man of rape. Her story of the outrage was clear and circumstantial. Yet after examining the lie-detector chart of her reactions under interrogation, a police officer felt there was something wrong. His deduction was proved right; investigation revealed that the girl had invited the accused man to her home. When her husband arrived earlier than expected, she needed an excuse for her behavior—a good one and in a hurry. The polygraph in this instance saved an innocent man.

Police accomplishments of this magnitude have given the lie detector a reputation for near infallibility.

Polygraph examiners (who average \$35 an examination) have a broad and seemingly lucrative field in which to exercise their specialty. It is estimated that there are currently 1,000 or more of them. Some are fly-by-nights intent on a fast and dishonest dollar.

One of the largest users is the U. S. Army Provost Marshal's Office. Some federal agencies also employ the lie detector to check those suspected of being security risks. Many banks, commercial houses, and department stores—places where both temptation and opportunity for theft are present—use the lie detector in employee checks. One large firm reported that a polygraph screening of its help revealed that three out of every four workers admitted the

Do Lie Detectors Lie?

theft of either goods or money—or both.

The lie detector has never been popular. This is scarcely surprising. For often its use may imply suspicion and distrust, without direct occasion for either. For example, if you want to get a job as a truck driver with certain bonded carriers, you must first be willing to take a polygraph examination. If you happen to get an incompetent examiner you may not get the job, and you'll wonder why.

The mistakes. A number of question marks surround the entire procedure. Some are scientific, some are moral and ethical. Not infrequently the untrained or inexperienced examiner makes mistakes. Or, more correctly, the polygraph's "many writings" are erroneously interpreted. It takes experience, too, to recognize a "false positive" reaction from the innocent or a "false negative" one from the guilty.

Today's leaders in the field of scientific interrogation are keenly aware of the critical storm lie detection has provoked from eminent persons in government, law, and medicine. These men are as anxious to see reform as are any critics.

For example, Cleve Backster, head of New York City's Backster School of Lie Detection, and a man who for the last 16 years has been a consultant to various government and law-enforcement agencies throughout the country, is especially emphatic in demanding that standards be raised. He estimates that an alarming percentage of U. S. polygraph examiners employ techniques that are obsolete.

"Hundreds of trained or semitrained examiners have entered the lie-detection field," he contends. "Because of this we are confronted with an important decision. If we allow the present trend of polygraph misuse to continue, the result can be devastating. Our only alternative is to do everything possible to upgrade and standardize the many varieties of technique in current use."

Backster has worked tirelessly for better training, the use of more sophisticated instruments, and standards of proficiency that must be met before an examiner is licensed.

Acutely conscious that shysters and incompetents have given the polygraph a bad name, Backster has pioneered new methods of evaluation. His fresh and more reliable techniques have been adopted by the U. S. Army's Fort Gordon Lie De-

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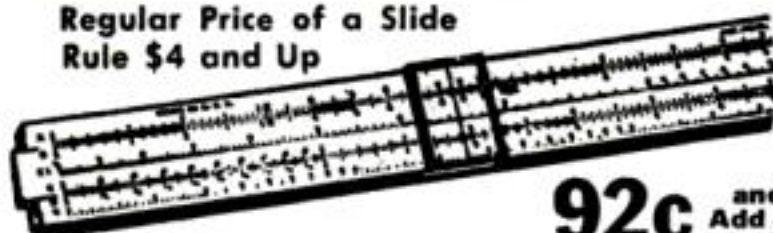
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Do Lie Detectors Lie?

detector School. They will now become standard procedure wherever Armed Forces detection tests are administered.

Should you take a test? The question is often asked whether one should refuse to take a lie-detector test. The best answer: It rests with you. It has been ruled legally that you do not have to take a test. A polygraph examination cannot be imposed on you without your consent. This would be a violation of your Constitutional protection against self-incrimination. The old argument that "refusal is evidence of consciousness of guilt similar to evidence of flight" has been turned down by the courts.

And what do you do if the polygraph seems to say you are lying when in fact you are being truthful? Cleve Backster suggests: "Get in touch with the Research and Instrument Committee of the Academy for Scientific Interrogation (165 West 46th Street, NYC 36), to see if there is a record of the examiner receiving *bona fide* training and whether he is listed as a member of a reputable polygraph professional organization."

The moral seems to be: Choose your polygraph examiner as you would your personal physician.

Legal recognition of the validity and reliability of lie-detector findings has not yet been won. The results of a polygraph examination are not admissible without prior stipulation in any of the country's courts.

Does all this mean that the instrument lies? No, because the polygraph reports truthfully the relative physiological changes taking place during questioning. That and nothing more.

At its best. Science still hesitates to give lie detection its blessing, principally because modern polygraph techniques that contain the necessary safeguards have not yet had widespread dissemination. What is reassuring is that lie detection by a skilled examiner utilizing the latest equipment has reached a level of accuracy that allows for consistent determination of the truth.

Today experts in the field are so confident that you can no longer fool a competent polygraph examiner that they universally advise: If you hope to deceive the polygraph, reconsider and avoid the examination. If, on the other hand, the truth will vindicate you, you'll find the polygraph a strong ally. ■ ■

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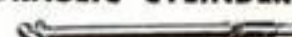
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Get home, if possible. If in doubt, drive home—if you can—to a shop you can trust. One garageman recently had an accident. “I didn’t like the looks of the shops,” he said, “so I had the alignment checked, doors jammed shut, then drove across two states to a place I knew in Iowa.”

Know the three kinds of jobs. Let’s say you have a 1962 or 1963 car with two doors badly torn below the windows. You’ll want (and are entitled to) a “like-new” job, new doors, and paint that glistens. Let’s say it costs \$200.

But if you have a 1960 car you might settle, instead, for a “good” job. Instead of buying new doors, you can have the lower panels cut out and good used panels—from a recent wreck—welded in. Such repairs can be every bit as good as the high-priced job—and cost \$125.

For a 1957 car that no longer shines as you’d like, you might be content with a \$75 economy job. Have the door frames jacked out, panels hammered and heat-stretched back as flat as possible (or filled), and a quick paint job sprayed on. Your car won’t look like a ’63 Cadillac, but you may need only safe transport and a decent appearance.

Some shops will quote all three ways.

Look for a reputable shop. How should you pick a shop? By its reputation. It’s sure-fire protection. Ask the gas-station men. In every town there is one top craftsman—one Rembrandt. They all know him.

Find him if you can. You may have to wait your turn—it’s worth it. I took my car to such a craftsman, an old-timer named Anthony Gross who is so famous that his shop was full of Cadillacs, Jaguars, Mercedes’, and Rolls-Royces. There, among the greats, I parked my Rambler. I saw his foreman, no less, wetting and sweeping dust that fell from fenders.

I asked his price and braced myself for a shock. You know what it was? \$129, including a beautiful door-straightening job and a new quarter-panel. And when I drove away he’d thrown in a free polish job—the whole car.

“We like our cars to look their best,” he said.

Be critical when you select a shop. Watch cars being fixed. Be wary if you see thick

gobs of plastic filler being slapped on to avoid straightening metal. Filler should be used very thin. Look at repaired cars. Try all moving parts: doors, hoods, deck lids, windows. Any tension? If so, something doesn’t fit. Latches work easily? Are doors too loose in the latches?

One test tells you whether a repaired door has been properly fixed. Slam it. If it closes with a tinny sound, the shop has failed to undercoat the inner surface of the panel.

Note alignment cracks around doors, engine hood, deck lid. Are they even? Are doors properly recurved? Chrome free of paint? Take a close look at repaired or replaced moldings. Are they rippled? Loose?

Get several estimates. How can you judge an estimate? Unless you’re a body expert, you can’t judge a single estimate. Get at least three.

An estimate should spell out all details. Will parts be new, used, or straightened? What will each part cost? Labor? Painting?

To help you judge the fairness of an estimate, most body men will cheerfully show you standard cost manuals and catalogues. Look for yourself. They’ll also tell exactly how much labor is involved. Thus if you get a \$90 estimate for a new door job, you know you may be spending: parts, \$35; labor, \$35; painting, \$20.

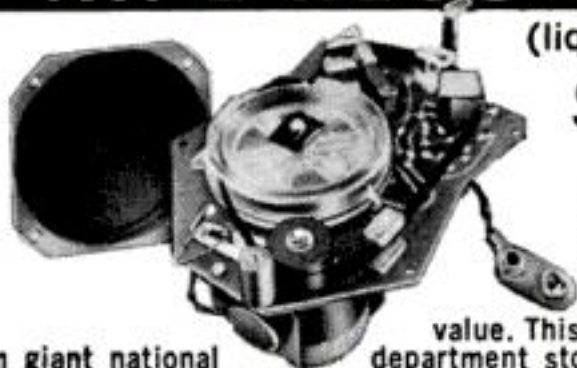
Agree on what you’ll get. Be sure you and the shop agree on these points:

Frame. Know how your frame will be straightened, if it’s bent. Some shops have powerful frame machines and frame-alignment instruments. Others jack frames as straight as they can, and if they can’t quite make them perfect may resort to washers or shims. And if screw holes won’t match, they may resort to welding in the wrong places.

Parts. Flat panel areas can be easily straightened like new. Compound curves and beadings, or ridges, are harder to fix, so new (or good used) parts may be in order. If used parts are to be employed, get a price allowance. (There are times when you may actually be better off with used parts. Some replacement door assemblies are practically impossible to buy new today, except at high cost.)

Welding. Let the shop know you expect good welding. Ed Dunn, a savvy insurance adjuster, says he sees many botched welds.

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How to Get a Good Body-Repair Job

They're hasty, incomplete, may crack later and allow parts to rattle, or let in soggy sand and salt. He also sees welds and torch burns left unpainted. Rust attacks such points more rapidly than ordinary metal areas.

Filling: plastic or solder? Some shops use only fiberglass plastic, and, by using it cautiously, do a good job. Some use it thin, for scratches, or put it in sharp V grooves where properly roughened metal can hold it. Good body men refuse to use thick (over 1/16 or 1/8 inch) plastic on large areas from which it can fall off. (Others load it on three or four inches thick.)

Some shops rely on old-fashioned, hard-biting lead solder for parts that get vibration and slamming: fender tips, hood fronts, deck lids, and doors (near hinges and latches).

And a few stick almost exclusively to solder for all filling. In some areas, adjusters say, there is a trend back to solder. It costs a bit more, but some body men swear by it.

Painting. Discuss the preparation carefully. Some shops sand a coarse tooth into bare metal; some don't bother. Good ones wash the metal carefully with solvents (gasoline or naphtha) to remove oils and moisture, even fingerprints. Others merely dust—and paint may fall off later if a dust rag contains a bit of oil. (And be sure moldings will be removed. Some shops only paint up to them, never underneath them.)

If you're paying for a good paint job, you're entitled to a lot of elbow grease. Some shops simply omit compounding, fine wet-sanding, and polishing. (Paul Pearl's shop finishes off a job, before polishing, with No. 600 sandpaper. "A lot of shops never heard of paper finer than No. 200 or 400," he says.)

Be sure you know how many coats you will get. A good lacquer job calls for at least five, preferably eight, coats over the prime.

If your finish is enamel, you're entitled to a quick "mist coat." Many shops omit it. This should dry at least five, not more than ten, minutes. Two fairly heavy finish coats are desirable.

Check the job. Make sure you got what you paid for by making these checks:

Paint. Is it dull, or clear and mirror-like? Can you see your reflection? Colors match? Is there any "orange-peel" pattern visi-

How to Get a Good Body-Repair Job ble—thousands of tiny freckles? (If so, the compounding and fine-sanding jobs were skipped.)

Metal. Make an "angle test." Let's say your right side was repaired. Stand in front of the right headlight and run your eye back along the side at an angle. Are there "waves" in the metal, or are all areas smooth, especially in sharply curved places? Do any sand-wheel patterns still show through the paint?

The undersides. Check parts you can't ordinarily see. Wayne Scranton, one expert body man, says he often finds inner wheel-housing panels slighted, holes unpatched, fender or hood braces and bumper brackets left unstraightened.

"All this will soon cause rattling," he says. "If my car is fixed, I want to get it up on a lift and see everything."

Lights, bumpers, moldings. Before you leave the shop, make sure (1) your bumper is straight (it's often misaligned), (2) moldings are not wavy or loose, and (3) lights are straight and refocused.

The cleanup. Be sure paint is wiped off chrome, and plastic or primer dust removed from the car (look inside door frames). And check for overspray. During painting, overspray often coats metal parts, windows, windshields. It should be wiped down afterward. If left, it hardens to a coarse surface on metal, to a gray fog on glass.

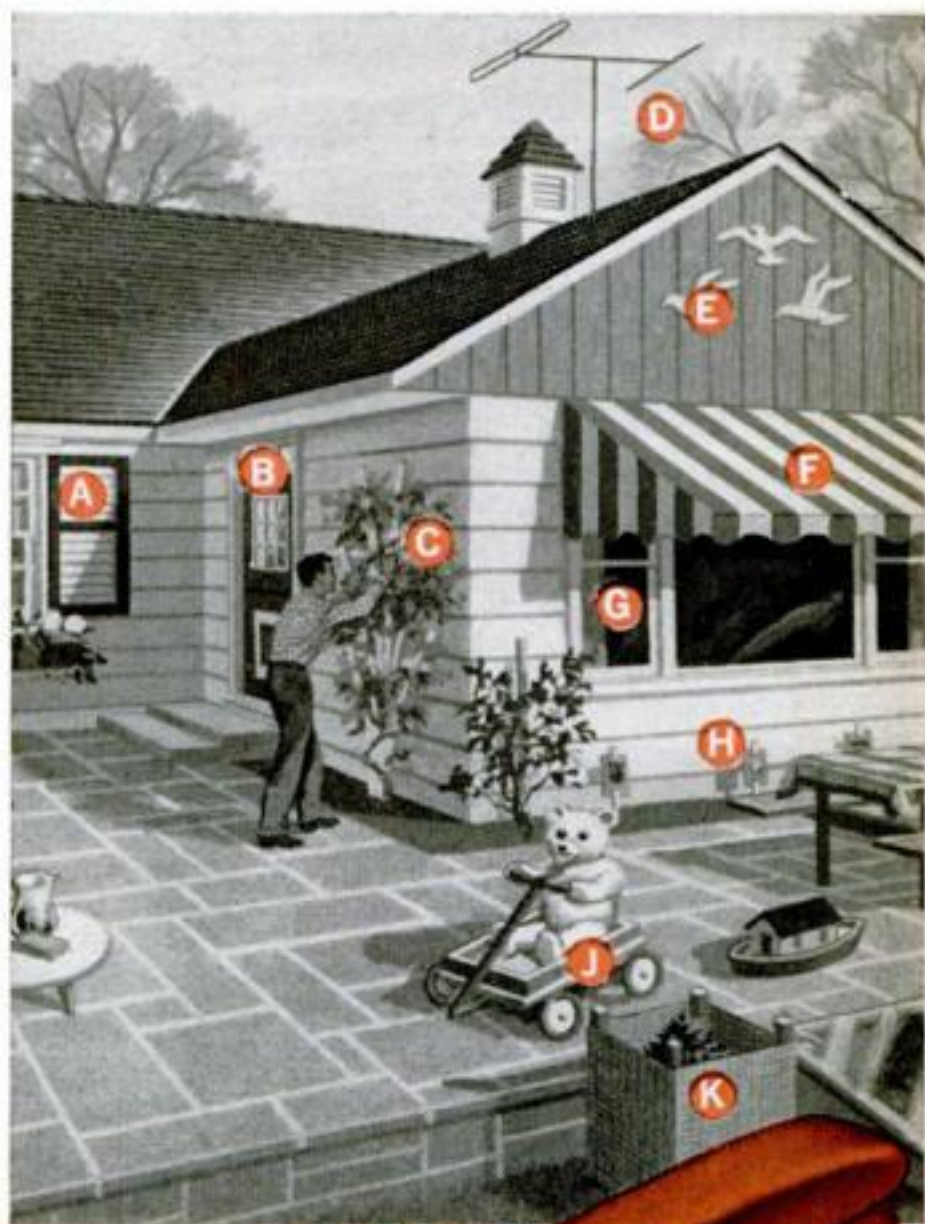
Go back and complain. Suppose you get a bad job? Let's say trouble develops, or you simply aren't satisfied with the kind of job you got. Body men agree: Any reputable shop will make good for its failures.

"We make some errors," one shop man told me, "and we can always tell when it really was our fault. Any good shop can. We never argue if we were wrong. We've even redone paint jobs a year and a half later. That's how we keep our reputation."

How many drivers come back with complaints? On \$100-\$200 jobs, a few—perhaps 10 percent. But on big jobs, this man said, almost half return. "Usually we expect minor adjustments, sometimes major ones."

Don't sign the release too fast. I learned that this is a common mistake. Most owners are hungry for the insurance check so they can get their cars back. Many immediately put the release in the mail—before they see their cars. Don't. Know that the work on your car is all right before you sign your rights away!

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Frank Coffyn in his Aeroquat.

Way back in 1912 ...

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OF ALL the shows put on by barnstormers in the early days of aviation, one of the most spine-tingling took place from Feb. 7 to 19, 1912, in New York City. One man and one flying machine were the whole show. From the first day, the city's five million residents got up each morning wondering if the plane and pilot could possibly survive till evening.

Almost every day provided another reason to speculate about the life expectancy of the pilot, 33-year-old Frank Trenholm Coffyn. On Feb. 13, for instance, Coffyn became the first aviator in history to fly under the Brooklyn Bridge.

He just barely made it.

As his Wright biplane, the "Aeroquat," reached the span across the city's East River, a tug with a tall smokestack arrived simultaneously—directly in Coffyn's line of flight.

Coffyn had to squeeze between the boat's stack and the bridge. Smoke and heat from

One-Man Flying Circus

the tug almost made him lose control. Puffy winds under the bridge, he reported that night, made his plane "act like a drunken thing." For no amount of money, he said, would he repeat that performance.

What the tugboat captain said is not on record.

Playing to the crowds. Less than nine years before, in 1903, the Wright brothers had picked out about the loneliest spot they could find for the experiments that got the first man-carrying airplane off the ground. Kitty Hawk, N.C., looked good to the Wrights because they wanted to be alone. Coffyn wanted a crowd so he could demonstrate the first Wright biplane equipped with pontoons, which he had designed. It was the typical fresh-air craft (no cockpit) of aviation's early days. The pilot sat on the lower wing. The engine was started by a hand crank, another Coffyn improvement.

Coffyn's first performance—and first close call—came on Feb. 7. A policeman rowing a skiff towed the Aeroquat to the middle of the Hudson River. Coffyn cranked the engine. As the two pusher propellers spun, he climbed up on the lower wing. The immediate danger: The river was perilously full of ice chunks. Coffyn, skittering around them, barely managed to take off.

He flew north to Grant's tomb, turned, and headed south toward the Statue of Liberty. The city's work virtually stopped as the crowds came out. Battery Park, at the southern end of Manhattan Island, was full of aerofans (as they were then called). Even the harbor police on duty had their necks craned upward.

The aerofans got an eyeful. Over the Statue of Liberty, Coffyn put on a show, "dipping and rising," said *The New York Times*, "as his mood seemed to suggest." Crisis loomed when he came in for a landing. There was a tug ahead of the Aeroquat. Coffyn gunned his engine, hopped over the boat, came down again.

Coffyn took up Jimmy Duff, a press photographer who sat on the lower wing with his legs dangling. The Aeroquat needed a longer run with the extra weight, but got through the teeming harbor shipping and finally rose. It dived right through fog, almost into a Staten Island ferry. The boat's whistle blasted, and Coffyn veered away. Duff got the first pictures ever made of New York City from a plane.

A few days later, Coffyn successfully

CONTINUED

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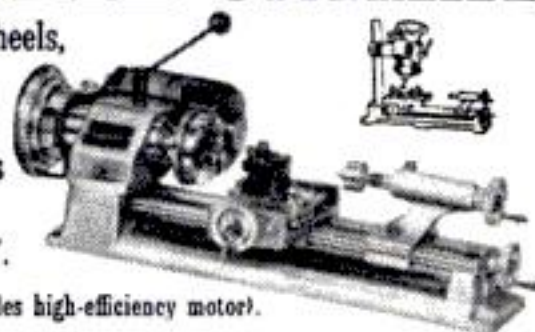
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One-Man Flying Circus

slipped under the Brooklyn Bridge without leaving his scalp behind. Next, he took the first movies of the city from a plane. He aimed and cranked the camera by hand, flying the Aeroquat with knees and feet. The wind bothered him again, coming, reported the *Times*, "from no steady direction, with a velocity jumping from 10 to 25 miles an hour. It was such a wind as no airman would have ventured aloft in 15 months ago, and few would care to encounter even yet."

Coffyn got, he said, "movies of skyscrapers full of rubbernecks." The rubbernecks saw plenty. At 800 feet he hit an "air pocket," dropped 200 feet before he could pull up.

"I knew it would be all right," said Coffyn, "because there was bound to be air somewhere between me and the water, but I didn't know how far we'd have to go to find it." Onlookers were less confident. Reported the *Times* the next day: "The crowd held their breath and counted on seeing the collapse of the aviator's brilliant career."

The movies no one saw. On Feb. 19, Coffyn went up with an automatic movie camera fitted with two electric motors. Weight: 75 pounds. No one ever saw the movies he took. The whole photo unit dropped overboard into the East River. Coffyn tried to grab the camera as it fell, but missed. Later he decided: "I was mighty lucky I didn't get my hands on that camera. It would probably have jerked me out of my seat and along with it into the river."

Besides demonstrating the Wright plane and his pontoons, Coffyn had wanted to show the public how safe a water-based aircraft was. Whether his hairbreadth escapes got this point across may be doubted. Still, by getting the attention of virtually all of New York City, his show played to a bigger audience than any other in the city's history, before or since.

Aviation always was safe for Coffyn. He was one of the few early birds whose luck never deserted him. He spent two years barnstorming the country and came out \$250,000 ahead.

In 1944, at a vigorous 66, he was still flying and was youthful enough to win private helicopter license No. 3. In 1956, at 78, he retired from the Hiller Aircraft Corp. On Dec. 10, 1960, almost 50 years after his series of escapades had set New York on its ear, he died in Palo Alto, Calif. He was 82.
—Gardner Soule

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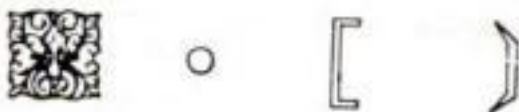
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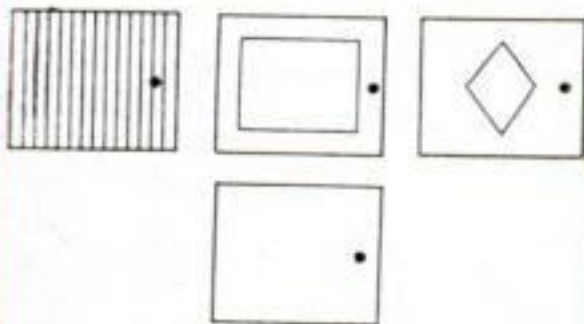
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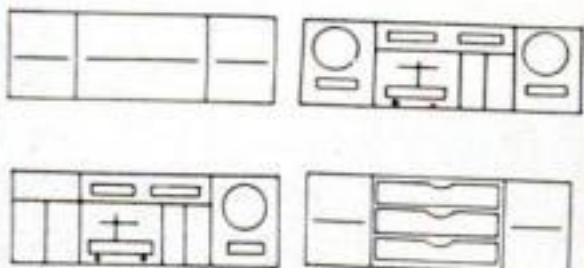
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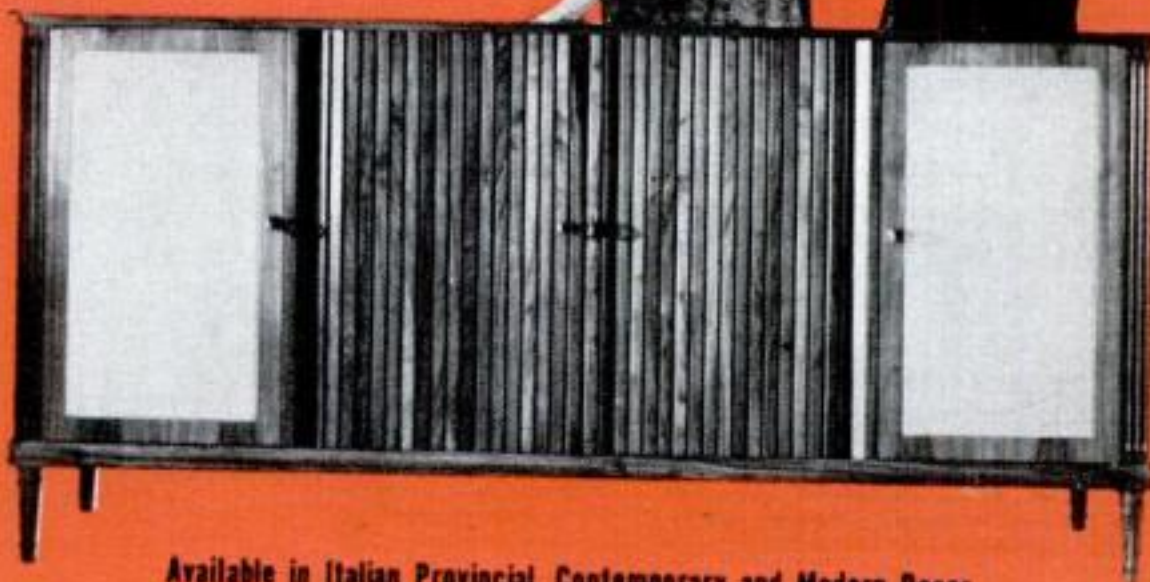
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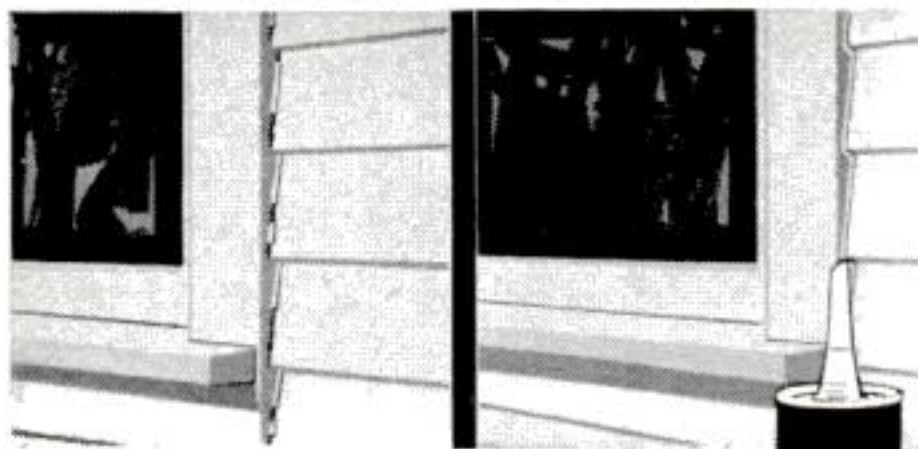
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Saab Story

[Continued from page 91]

One of the most unusual features on the Saab is its freewheeling device. Lift your foot off the gas and the transmission is disengaged, allowing the car to coast with engine idling.

This may be disconcerting to drivers who are used to downshifting to let engine compression provide braking, but there are advantages: greater fuel economy, less engine wear, no need to declutch when shifting. For push-starts or descending long grades, the freewheel can be locked out.

Obviously, with no engine braking the brakes have to be good. And they are. The finned drums showed little sign of fade.

As is typical of front-wheel drive, steering is heavy at low speeds, and there's considerable wheel fight during hard acceleration, especially under full steering lock. But in normal cruising, steering is fairly light. It's precise and fast.

Handling can best be described as fantastic. Thanks to its fine cornering, the Saab has racked up an impressive record of rally and class-racing wins throughout the world. The car is stable at high speeds, even in strong crosswinds. It's an understeerer—it wants to go straight, instead of cornering, at speed—because of its nose-heaviness and front-wheel drive. The fastest way through a corner is to feed throttle. But even if you let up on the gas halfway through, only the clumsiest steering maneuvers will make the rear end slide out. In snow, the Saab is practically unstoppable.

Ride is firm, compared with U.S. compacts, but comfortable considering the size of the car. Visibility is good, but fenders are hard to see. With windows shut, there's no wind noise; open them a crack, though, and normal conversation becomes difficult.

The steering wheel is comfortably placed. Pedals are offset slightly to the center because of infringing wheel wells, but this never becomes bothersome. The hand brake obviously was designed for apes; mounted low between the seats, it's almost out of reach for a driver with arms of average length.

The rear seat holds two comfortably. Try to cram in three, as the manufacturer optimistically suggests, and they'd better be on very friendly terms. Finish is excellent inside and out. The trunk is cavernous.

Handling, economy, reasonable comfort—what more could anyone ask? ■ ■



#74—Derringer-type Gun Lighter with wood stand looks like the real thing! Shoots a light for cigarettes every time you pull the trigger. You can't miss with this handsome piece on your desk, or an end table at home. Loaded as a conversation starter! Add 50¢ postage. \$5.00



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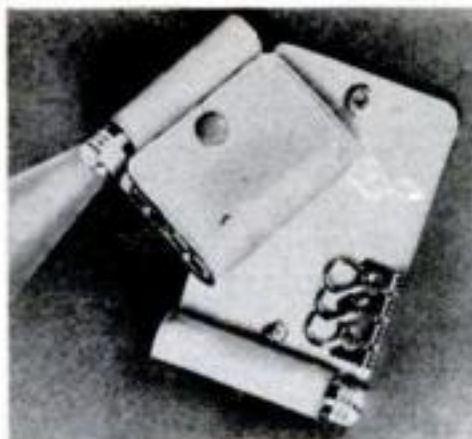
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The Man Who Put the Pace in Space

[Continued from page 92]

associates rushed to Lynn, Mass., to arrange to use the equipment for wind tests.

It meant working nights, and even on Christmas Day, with equipment GE said might be a bit awkward: The speeds might vary; loose parts might be flung about.

In this way Dryden discovered the strange shifts in pressure and the air-flow problems of sub-, tran-, and super-sonic flight in 1925—a generation before the first jet broke the sound barrier.

The skilled analysis that led to improved wind tunnels; the theoretical studies of laminar flow, of turbulence, and boundary-layer problems would have been enough to establish Dryden's reputation during the score of years that followed. But there was practical work, too: studies of wind pressure (one of which, incidentally, reassured designers that the Empire State Building wouldn't blow over) and safety tests. A mid-air fire had destroyed the first clipper to try a route from San Francisco to Australia. Dryden's wind-tunnel tests showed that jettisoned fuel might ignite if there were recessed areas on the plane to trap it. Put the fuel outlets in the airstream, he observed, and any flames that developed would be blown out.

World War II saw Dryden direct the only successful guided-missile project, the radar-homing glide bomb "Bat." On V.E. Day, he, along with colleagues Dr. Theodore von Kármán, George Schairer of Boeing, and others, was in Germany as part of a select intelligence group appointed by Air Force General Henry Arnold. Their mission: find out how effective German military science was.

To their surprise they found that much of the German war effort was split. At Peenemünde scientists worked on supersonic flight; at Volkenröde the work was largely subsonic. Some revelations did take place, however. George Schairer was dazzled by the German advances in swept-wing design. He came back to the United States—and the B-47 was born.

In 1947 Dryden switched from the Bureau of Standards to the National Advisory Committee on Aviation. When NACA became NASA in 1950, he stepped in as the ranking scientist. Last year he received a Rockefeller Public Service Award in recognition of a lifetime devoted to science and government.

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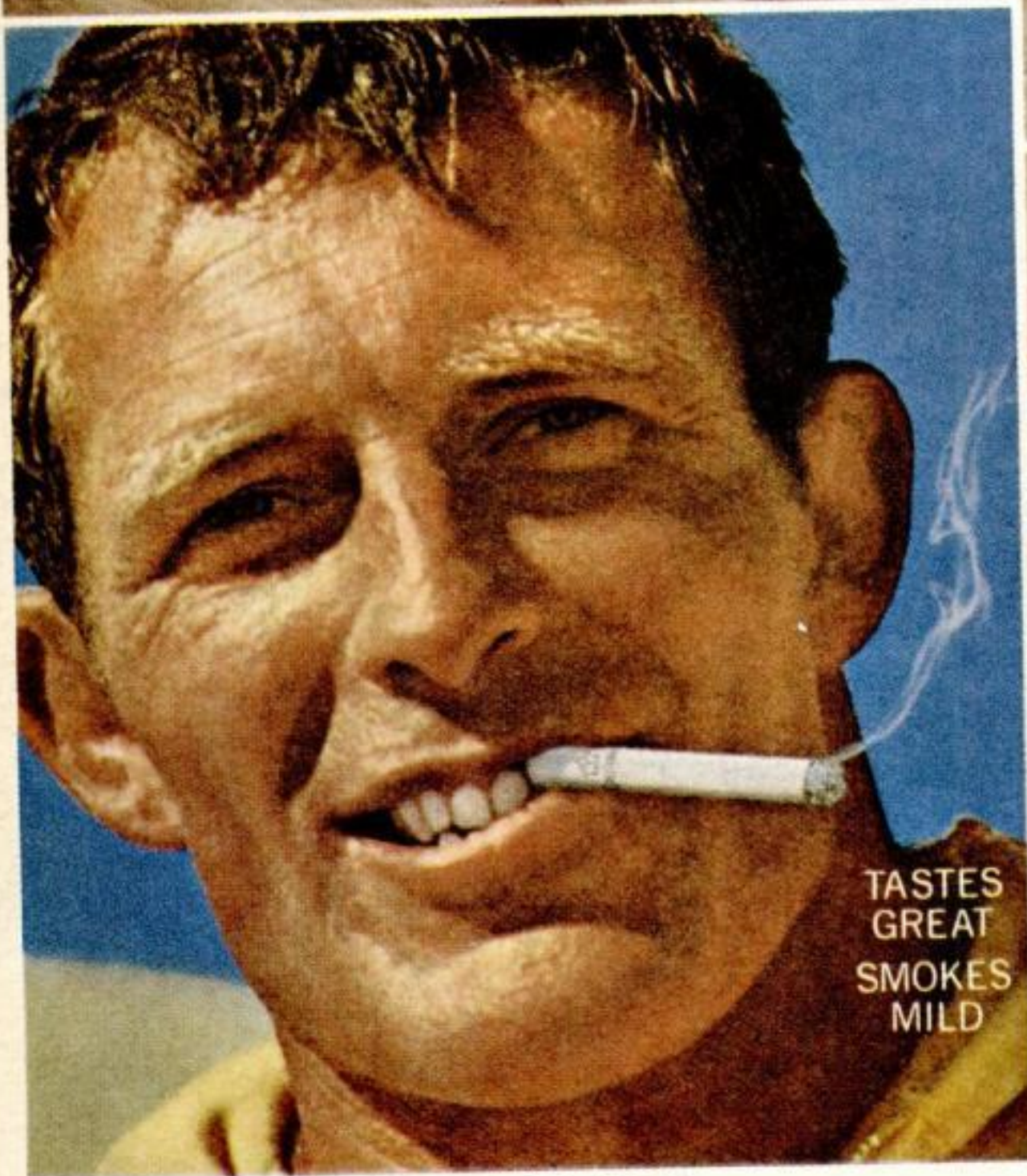
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